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DIVISION OF VEGETABLE PATHOLOGY.

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THE JOURNAL OF MYCOLOGY:

DEVOTED ESPECIALLY TO THE STUDY OF FUNGI IN THEIR RELATION TO PLANT DISEASES.

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DIVISION OF VEGETABLE PATHOLOGY.

CHIEF,

B. T. GALLOWAY.

ASSISTANTS,

EFFIE A. SOUTHWORTH, DAVID G. FAIRCHILD, W. T. SWINGLE,
ERWIN F. SMITH, JOSEPH F. JAMES.
MERTON B. WAITE.

PUBLICATIONS OF THE DIVISION OF VEGETABLE PATHOLOGY.

The Division of Vegetable Pathology, formerly a section of the Botanical Division, has become a separate organization by act of Congress. Its bulletins will henceforth be numbered independently and in a new series; but the following list contains all publications issued since its organization as a Section, together with Bulletin 1 of the new series.

Bulletins and circulars still on hand for distribution are designated by an asterisk (*). Bulletins 1, 3, 4, and 6, omitted from the list, are publications of the Division of Botany, not relating to vegetable pathology.

JOURNALS.

Journal of Mycology, Vol. v, Nos. 1, 2, 3, and 4. 1889–'90, pp. 249, pl. 14. Vol. vi, Nos. 1, 2, 3, and 4.* 1890–'91, pp. 207, pl. 18. Vol. vii, No. 1,* 1891, pp. 63, pl. 10.

BULLETINS.

No. 2. Fungous Diseases of the Grape. 1886, pp. 136, pl. 7.
No. 5. Report on the Experiments made in 1887 in the Treatment of Downy Mildew and Black Rot of the Grape. 1888, pp. 113.
No. 7.* Black Rot. 1888, pp. 29, pl. 1.
No. 8.* A Record of Some of the Work of the Division. 1889, pp. 69.
No. 9. Peach Yellows. 1889, pp. 254, pl. 36.
No. 10. Report on the Experiments made in 1888 in the Treatment of Downy Mildew and Black Rot of the Grape, pp. 61.
No. 11. Report on the Experiments made in 1889 in the Treatment of Fungous Diseases of Plants. 1890, pp. 119.
Farmers' Bulletin No. 4.* Fungous Diseases of the Grape and their Treatment. 1891, pp. 12.
No. 1.* Additional Evidence on the Communicability of Peach Yellows and Peach Rosette. 1891, pp. 65, pl. 39.
Farmers' Bulletin No. 5*. Treatment of Smuts of Oats and Wheat. 1892, pp. 8, pl. 1.

CIRCULARS.

No. 1. Treatment of Downy Mildew and Black Rot of the Grape. 1885, pp. 3.
No. 2. Grapevine Mildew and Black Rot. 1885, pp. 3.
No. 3.* Treatment of Grape Rot and Mildew. 1886, pp. 2.
No. 4.* Treatment of the Potato and Tomato for Blight and Rot. 1886, pp. 3.
No. 5.* Fungicides or Remedies for Plant Diseases. 1888, pp. 10.
No. 6.* Treatment of Black Rot of the Grape. 1888, pp. 3.
No. 7.* Grapevine Diseases. 1889, pp. 4.
No. 8. Experiments in the Treatment of Pear Leaf Blight and Apple Powdery Mildew. pp. 11.
No. 9.* Root Rot of Cotton. 1889, pp. 4.
No. 10.* Treatment of Nursery Stock for Leaf Blight and Powdery Mildew. pp. 8.
No. 11.* Circular of Inquiry on Grape Diseases and their Treatment. p. 1.
No. 12.* Circular of Inquiry on Rust of Cereals. p. 1.

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ANNOUNCEMENT.

With the present number of the JOURNAL there is a new departure in relation to the Index to Literature. Heretofore it has been confined to American publications, but in this and subsequent numbers the scope will be enlarged to include foreign papers. The arrangement also will hereafter be different; instead of being strictly alphabetical the papers will be arranged according to subjects. This will render it easier to look up any special subject, and it is believed will make the Index more valuable. The papers will be noticed by different members of the divisional force, and initials appended to each review will indicate the responsibility for the notice.

The Index is designed especially to aid Experiment Station workers and others in this country who do not have access to the more important literature on plant diseases and allied subjects. In order to make the Index more valuable, especially as regards accessibility, it is suggested that the various items be cut out, pasted on cards, and then arranged alphabetically according to authors and subjects. For this purpose we use the Library Association's standard cards, No. 32, 5 by 12½ centimeters. By adopting this method, new cards may be inserted at any time, thus making it possible to keep all of one author's writings together, or all that has been written on any one subject. Those desiring to adopt this plan can obtain extra copies of the Index by writing for them.

In order that we may make the Index as complete as possible, it is earnestly requested that authors everywhere forward to the Division of Vegetable Pathology their publications relating to plant diseases as soon as they are issued. These will be kept on file in the divisional library for convenient reference.

A DISEASE OF ALMOND TREES.

By Newton B. Pierce.

(Plates XI—XIV.)

During the early part of August, 1891, while engaged in work on the vine disease of southern California, the writer observed a number of almond trees east of the village of Orange, Orange County, severely affected by a fungus infesting the leaves. This parasite is *Cercospora circumscissa*, Sacc., a form also occurring on *Prunus serotina*, the wild black cherry of the East.

The affected trees observed were large and old, but, according to Mr. Moore, the manager of the place, were unfruitful. The leaves were riddled by the fungus. Several trees had lost most of their foliage, which thickly carpeted the ground. Owing to the perforations of the parasite most of the fallen leaves looked like strainers. It seemed probable that they had fallen earlier than they would had the fungus not been present, but owing to the lack of previous observations I could not then speak positively. The observations of Mr. Ellwood Cooper given below confirm this opinion.

After these observations many others were made throughout the region. Scattered trees were seen in many orchards, and all were more or less affected. Later in August I visted Florence, Los Angeles County, and there observed the same effects, but less seriously developed. In the latter part of the same month I conversed with Mr. L. Thurston, at Santa Ana, in relation to this disease. The Thurston place has one of the most profitable almond groves of Orange County, and is near Arch Beach. At the close of September, Mr. Thurston wrote an account of the disease in his orchard, saying that the leaves remaining on the trees were seriously affected, while those already fallen, comprising most of the foliage, were completely riddled by the parasite. Mr. Ellwood Cooper, State horticultural commissioner, who has large almond interests near Santa Barbara, Cal., writes as follows respecting the disease:

> The disease here has been very bad for several years; I can not recall its first appearance on my place. I have over 10,000 trees. They generally cast their leaves in June and July. The first appearance of the disease is a yellowish brown spot on the leaf. * * * Very soon the round piece falls out and the leaf falls from the tree. Sometimes there are a number of such spots in each leaf. [This is nearly always true.] It causes the leaves to fall too soon and before the woody portion has been perfected, and hence an insignificant crop the coming year. The blight does not seem to get any worse, but it is bad enough to cause great loss in crops.

It is evident that *Cercospora circumscissa*, Sacc., has developed to a very injurious extent in California, especially in the coast region. The coast counties will always be apt to suffer most from its action because of the frequent fogs and the greater general humidity of the atmosphere. Almond leaves from St. Helena, Suisun, and Acampo, Cal., fail to reveal the presence of *C. circumscissa*. Some "shot hole" fungus, however, is injurious at Suisun.

SOME OF THE STOCKS AFFECTED.

According to Mr. J. B. Ellis, *C. circumscissa* has been found on the peach in Florida by Mr. Calkins. The form affecting the almond and that on the peach, as found in California, are doubtfully distinct. Peach trees grown in close proximity to affected almond stocks may produce fruit considerably marked by this fungus. On one peach many conidia were found. There is evidence that this form does not readily mature spores on the peach, although many points of infection may be present. Thirty-six such points were seen on one stunted peach an inch in diameter. The fungus produces on the fruit a black, circular, depressed spot, which injures its appearance, although the decay does not extend inward more than one-eighth of an inch. All parts may be affected and the spots somewhat resemble those produced on the same fruit by *Cladosporium*. The leaves of peach trees are likewise considerably affected by *Cercospora*. The trees affected are only those situated so near diseased almonds that infection may occur by spores falling or blowing from them. On a portion of one peach tree thus situated the leaves near the almond were nearly destroyed. (Plate XI, Fig. 1.) Peach trees in other portions of the orchard, even those growing within 40 feet of the affected almonds, were virtually free from the disease. Leaves from peach grafts on almond stocks growing at Arch Beach showed the characteristic spots, although the conidia of *Cercospora* could not be found on the material received. These facts indicate that some immediate source of infection extraneous to the peach tree itself must be present before the tree will suffer from the disease. This is explained by the habits of the fungus on peach leaves. While these leaves obtained near affected almond stocks are often thickly infested, a single leaf sometimes showing forty or fifty characteristic points of infection, there are rarely more than two or three of these which bear conidia. They are mostly sterile on both surfaces of the leaf. The parasite penetrates and lives within the peach leaf, producing its usual effects, yet apparently fails to find the proper food supply or other conditions required for reproduction. The fact that the peach tree is usually infected from the almond is opposed to the view that the *Cercospora* found on the former is distinct from that occurring on the latter in California. Peach twigs are in rare instances infested by this fungus.

There is evidence that prune leaves are affected when the prune is grafted to almond stock. Nectarine leaves are also known to be attacked by *Cercospora circumscissa*. Leaves from two-year-old nectarine grafts on diseased almonds grown on the place of Mr. Thurston were infested.

GENERAL AND SPECIAL EFFECTS OF THE FUNGUS.

On the almond tree the effects of this parasite appear on the new and old wood, the leaves, and the nut husks. The most important direct effects are on the leaves. The indirect action of the parasite is due to this injury of the foliage. When the foliage is seriously affected it falls prematurely, leaving the new wood partially ripened or immature. Where soil conditions will admit, a new terminal growth follows the defoliation. This may be compared to the renewal of peach foliage on trees denuded by the "curl-leaf" fungus, *Taphrina deformans*, Tul., though the recovery and reclothing of the almond is less complete. Where the soil conditions are unfavorable and moisture is deficient this secondary growth does not result. On the contrary the immature terminal wood becomes more or less dried and dead. The following season many shoots may be broken with the thumb and finger. As the almond usually sheds its foliage early in the season and before the nuts have fallen, leaving the tree mostly denuded during the latter portion of the summer, any hastening of the defoliation subjects the immature wood to extremes of dryness and heat. In this respect there is a contrast between the situation of the denuded almond tree and that of the peach tree defoliated through the action of the leaf rust, *Puccinia pruni-spinosæ*, P. In the latter case the leaves fall late in the season, after the extremes of drought and heat are moderated and the wood is less apt to become dry. The new foliage of the almond becomes infested like the spring foliage, but it is fresher and healthier than the latter at its fall. This arises largely from the recent pushing of the growth rather than through any diminution in the virulence of the disease.

The trees and earth are covered by millions of spores capable of germinating within a few hours if placed under proper conditions of moisture. The humidity of spring is favorable to germination, while the spores are more numerous in the fall. Infested spots on the twigs are represented on Plate XI, Figs. 2 and 3. Fig. 2 is of natural size and represents new wood, while Fig. 3 is of old wood enlarged 2½ diameters. In the former are shown nine points of infection in a little more than 2 inches. The tissue here involved is sharply defined at the margin; and this is in general characteristic. The circular portion of the cortical tissue often falls out, leaving scars or pits in or through the bark of the twig. In other cases the dead tissue clings to the twig by the center of its inner surface, while the margin has warped outward, giving the piece the form of a watch crystal attached by its convex surface. A rather exceptional case is shown in Fig. 3. This view is sufficiently

large to show the form of the affected disk with its central spore clusters. The fact of special interest here, however, is that the tissue of the branch is altered to a considerable distance from the disk of infection. This is shown by the darkened outer side of the twig. It is the under and more protected portion of the branches which becomes most thickly infested by the parasite. A branch one foot long and three-eighths of an inch in diameter bore twenty points of infection on the upper one-third, while 104 such infections were on the lower two-thirds. This condition is common, and it bears on the application of sprays for prevention. The protection from the heat of the sun on the under surface of limbs gives better conditions for germination and growth and probably accounts for the greater number of infections there.

Transverse sections show that the parasite sometimes kills the tissue of the branch as far inward as the cambium zone and xylem bundles. Figure 4 of Plate XI represents such a section magnified 16 diameters. The cortical parenchyma is mostly affected, but at the center of the affected spot the parasite has destroyed the phloëm and cambium tissues, even penetrating slightly into the xylem rays. The fruiting bodies of the fungus are indicated at the margin of the section near the center of the infested spot. It can not be doubted that twigs infested in this manner at hundreds of places are much injured.

The direct action of *C. circumscissa* on the nut is of little or no importance. It can not penetrate the kernel, and it is only found on the husk, where the characteristic circular spots occur.

The leaf of the almond is the most generally attacked and most seriously affected portion of the tree. In the young and tender leaf, when viewed by transmitted light, the recently infected tissue shows a yellowish spot varying in size according to the state of advancement. This spot presents at this time a dark center. By reflected light the center appears light and the margin dark. Later the sclerotia or tubercular parts of the fungus develop, mostly within the limits of the central area, though not confined to this portion, and when the fascicles of conidia have arisen from them there is a blackish point within the light center. Viewed as an opaque object under a low power these spore clusters are of a dark olive-green color. When the conidia have arisen the infected tissue often assumes quite a dark color about its margin, which is usually well defined and nearly circular. Under the action of the parasite the affected piece soon dries sufficiently to shrink both in thickness and breadth. The shrinkage in breadth causes its rupture from the surrounding and more or less healthy tissue. It soon becomes entirely excised and falls to the ground. The opening left is bounded by partially dead and thickened tissue, and it looks as if made by fine bird shot. The entire effect resembles that produced on apricot, prune, almond, peach, and other leaves by the Australian "shot-hole" fungus, *Phyllosticta circumscissa*, Cooke. It is distinguishable, however, in most cases,

from the effects of that fungus, even to the naked eye. In many instances the openings in the almond leaf are bounded by the finer veins or vascular bundles. The midrib is rarely divided by *Cercospora*, and the larger secondary veins often prove an obstacle to its extension. In some instances cells are formed about the infested tissue of these circles apparently as a protective provision, and they are perhaps comparable to the transverse cells cutting off leaf petiole and blade when of no further use to the plant. More observations are needed to determine if this growth be common or exceptional. Where infection occurs near the margin of a leaf the opening left is semicircular, and resembles the work of the leaf cutter bee, *Megachile*. The outer effects of this fungus on the leaf are figured (Plate XI, Figs. 1, 5, 6). Figs. 5 and 6 are of the almond leaf, and represent the greater part of a leaf of natural size, with a smaller portion enlarged about 3 diameters. Fig. 1 is of a peach leaf badly infested by *Cercospora*, also natural size.

We learn through a study of the leaf tissues that all portions are involved in the effects of *Cercospora circumscissa*. The vessels are filled with a reddish, amorphous, gum-like deposit, the entire vascular bundle being involved in the discoloration. The compact upper palisade cells are shrunken and wanting in chlorophyll and amylaceous material; and this is also true for the lower, more openly arranged palisade cells or spongy parenchyma. The cell walls are yellowish, while the cell lumen usually contains a yellowish granular deposit in greater or less abundance. So far as observed, most of the chlorophyll bearing cells have their walls uninjured.

DISSEMINATION OF THE DISEASE AND PREVENTIVE MEASURES.

The small circular pieces of diseased tissue excised from the leaves of affected plants unquestionably provide for a ready spread of the disease. They bear near the center of one or both surfaces fascicles of abundant conidia. Prior to their fall from the leaf, these pieces of tissue commonly warp into the form of a watch crystal or even a cup. Moderately warped pieces are shown in cross section in Figs. 7 and 8, of Plate XI. The margin of the piece may warp either upward or downward, but in either case many fascicles of conidia are protected at the center of the concave surface from the touch of most external objects. The diameter of the cup-shaped pieces varies from 1 to 6 millimeters, and they may protect from one hundred to several hundred conidia. The spores arising from the convex surface are soon freed and scattered. Those within the concavity are retained much longer and until the pieces may be blown or carried by the water of irrigation for long distances. Unquestionably both the minute size and peculiar shape of the spore-bearing tissue greatly facilitate the dissemination of spores. Water readily separates the mature conidia from their conidiophores, and in case of a light shower they are freed and distributed over surrounding foliage in

vast numbers. Mist or fogs are not so apt to free the conidia,* but these are favorable to germination.

It is, perhaps, too early to consider preventive measures, as thus far no experiments, so far as I am aware, have been conducted to this end. There are one or two suggestions, however, which it may be well to make in view of the observations in the field and laboratory.

(1) Let all fallen foliage be gathered from beneath infested trees and burned.

(2) Have the earth beneath the infested trees carefully and completely turned under, the deeper the better.

It is important that spray applications of known fungicides should be made with thoroughness, both to trees and soil, to the latter after the fall of the foliage. In applying sprays to the tree it should be remembered that a great majority of the spores of *Cercospora circumscissa* are produced on the under surface of the leaves and branches.

OBSERVATIONS ON THE PARASITE.

The microscopical study of *Cercospora circumscissa* reveals much variation in form and habit. There are presented, by means of the camera lucida, some of the variations observed in the production and form of its conidia. There are also given numerous figures showing the characteristic but greatly varying habit of germination. (Plate XII.)

The conidia vary both in length and form. They are from 1 to 6 or 7 celled; mostly 2 to 5 celled. The distal one-fourth to one-half is usually reduced in transverse diameter and the cells are longer than those of the proximal portion. Toward the base of the conidium the cells are often somewhat distended at the equator. This gives the basal half a slightly undulating outline from septum to septum. The width of the distal end varies between 3 μ and 4 μ, while the greatest breadth taken toward the base varies between 4 μ and 6 μ. The basal cell contracts rather abruptly toward the end, to a transverse diameter about equal that of the distal end of the conidium. The length of the conidium is found to vary according to certain favorable or unfavorable conditions of growth. The most common variation is between 22 μ

* The formation and attachment of the conidia are examined with difficulty in water. When a section bearing conidia is placed in water the spores become free. This may be avoided by placing the sections upon the slide nearly dry and afterwards moistening them gradually by breathing beneath the cover glass. The condensed vapors soon gather about the conidia and answer the purpose of a water mount in the transmission of light rays, while the conidia remain attached to their conidiophores. Glycerine or water may afterwards be run under the cover glass with much greater safety. When profile views of attached conidia are desired it is convenient to cement the back of the spore-bearing leaf tissue to a section of cork 2 millimeters in thickness. When dry the cork serves as a firm support in sectioning; and, owing to its thickness, it insures that the section shall lie so that the desired profile view is obtained. The cork is removed by running water over the sections and then teasing them with a fine brush.

and 64 μ, but in many measurements I found conidia from 20 μ to 106 μ in length. One hundred measurements gave an average of 40.6 μ. The conidia have a straight or variously curved form, and even bifurcate examples occur. They are often enlarged upon one side, and it is common to find their course quite angular in places. Instances are observed where projections extend out laterally much as when germinating, although these projecting cells have heavy walls like the remainder of the conidium. Not infrequently the basal cell is pyriform. The walls of the conidium, as well as the transverse septa, are mostly about $\frac{1}{2}$ μ in thickness, distinct, yellowish, and firm. The cell contents are of a clear yellowish color and finely granular. When the conidium has been in water for a few hours the cell contents become more distinct, and what seem like small oil drops appear and becomes aggregated at or near the ends of the cell. This is the first step in the process of germination.

In germination the contents of the individual cells of the conidium press toward the ends. There appears near either end of the cell a number of small, yellowish, refractive bodies resembling oil drops. These may also be distributed through the entire cell, although most abundant at the ends. The general contents of the cells become more distinct. Through endosmose the cell soon grows turgescent, and by the pressure towards the ends the walls become distended, leaving the equator of the cell with a less diameter than the ends. This is a direct change of the condition in the cell prior to the first steps in germination. At the ends of the conidium the enlargement may become almost knob-like before any germ tube is evident. At the extremes of the cells about to develop tubes, the protoplasmic contents become fine and clear, while the cell wall at these points soon disappears, and growth begins by the pushing out of the tube or hypha. In a large number of germinating conidia observed at various times, the germ tube has nearly always arisen directly from the end of the cell or from the angle between the cell wall and septum. In comparatively few cases germination takes place directly from the side of the cell. While the cell contents are being arranged preparatory to germination the entire conidium is often seen to be passing through a new stage of development. It curves to one side in such a manner as to allow the individual cells of which it is composed to partially divide from one another. In many cases this process of division is not carried further than to allow the separating cells to assume a position at right angles to each other, thus leaving the newly separated ends of each exposed. Though only a portion of the cells become wholly separate in slide cultures, it is probable that, were the germ tubes to penetrate a natural substratum, these half divided cells would separate. It is interesting to note what advantages may arise from this strange turning to one side of the parts of the conidium. In the first place it exposes a new and tender cellulose wall at the end of the dividing cells, admitting of an easy protru-

sion of the germ tube. It also provides that each germ tube shall be directed at an angle, often a right angle, to the direction taken by that of its fellow cell, insuring different points of infection. In case of the entire division of the cells of the conidium, still another aid to immediate dissemination is obtained. In one instance a germ tube was seen which originated from a second or inner cell, passed through the septum to the terminal cell and out at the end of the latter. (Plate XII, Fig. 23.) The germ tubes in moist cultures grow out into long mycelial hyphæ, which at an early stage appear destitute of septa, but when older the septa become distinct and often quite near together. The contents of the new hyphæ are quite clear and finely granular. The branches are not very abundant, but moderately so in some cases. They mostly arise at right angles to the parent hypha. The thickness of the parent hyphæ is well maintained through their length, although diminishing slightly to the end. There are, however, some cases where the hyphæ are enlarged or contracted at various points in their course. Conidia recently matured germinate in moist cultures very readily after a period of three or four hours; those having been matured several weeks germinate more irregularly and slowly.

The mycelium within the host plant is composed of hyphæ very similar to those of germinating spores. At points adjacent to the spore clusters the hyphæ are apt to make more or less abrupt turns, and at the angles they are sometimes considerably swollen. While culture hyphæ are rarely more than 4 μ in thickness, often considerably less, those near forming spore clusters in the leaf may reach 5 μ in thickness or even more. As the hyphæ branch and grow through the tissue of the leaf their thickness is reduced till those distant from the spore clusters are very fine. In general the hyphæ vary in thickness from 3 to 5 μ. They have been seen in all the tissues of the leaf, and nearly always occupy the intercellular spaces. They are seen to wind among the cells of the palisade tissue, in some cases going directly down between those cells to the more loosely arranged palisade tissue or spongy parenchyma as the case may be. I have seen numerous hyphæ in the epidermal cells, and one hypha passed for a considerable distance, from cell to cell, through the epidermis. The finer vegetative hyphæ are quite clear and are not easily distinguished, while their septa are seen with much difficulty. The larger hyphæ are more distinctly septate and the finely granular contents are rather indistinct. The walls are distinct under an enlargement of 500 to 800 diameters.

At or near the center of the affected leaf tissue the mycelial hyphæ become grouped, either within the epidermal cells or just below them. Here is formed a tubercular mass of heavy-walled cells, giving rise to erect thick-walled hyphæ or conidiophores. The tubercular mass when soaked for several days in water may be pressed and teased apart, so as to show that it is a compound body made up of groups of thick-walled storage cells supported upon a single hypha of the mycelium. These

thick cells give rise to from 1 to 6 or more conidiophores. I have figured the tubercular mass and several of the component groups of cells with their single hyphæ and varying number of conidiophores. (Plate XIII, Figs. 1–7.) The compound tubercular masses vary greatly in size, usually 3 to 15 μ in diameter. The number of conidiophores arising from them commonly varies from 20 to 50, but I have seen two well-developed conidiophores issuing alone from a stoma and having a well-defined tubercular base, with at least two distinct mycelial hyphæ springing from it. It is also common to find a greater number than 50 conidiophores in one fascicle.

The fascicle of conidiophores pushes through the epidermis, or, in some cases, through a stoma. The cuticle is raised, pierced, and broken by the pressure, and the conidiophores arise to a height of 14–43 μ or more. The walls of these conidiophores are rather thick, but not as dark in color as they afterwards become. The conidiophore may be simple with the basal part somewhat swollen, or it may be more or less twisted and curved. It is common to find the distal end sharply bent to one side and then turned upward, giving a shouldered form. Where this is repeated it forms a dentate end. I have seen at least five such irregularities in one conidiophore. From the tip of this straight, curved, shouldered, or toothed conidiophore arises the conidium already described. For stages in the growth of the conidium see Plate XI, Figs. 9–17. In some cases two conidia have been seen attached to the conidiophore at the same time. One arose from the curved tip, and the other from the shoulder of the conidiophore. From the number of curves made by the conidiophore it appears probable that several successive conidia are sometimes produced upon them. In transverse diameter the conidiophore varies between 3 μ and 5 μ, but when shouldered the tip is much reduced. The fascicles may be at first made up of slightly curving and mostly tapering conidiophores. They may present a mingling of the curved, shouldered, and toothed conditions, or else, especially when old, wholly composed of the shouldered and toothed forms. The matured conidiophore is capable of sending from its extremity a secondary growth in cases where much moisture is present. This new growth takes the form of a tubular prolongation, and in some cases observed it has produced terminal conidia. In one instance two conidia were attached to this secondary prolongation. The wall of this secondary growth is lighter in color than the basal matured portion. As shown in Fig. 8, Plate XIII, these secondary growths become shouldered as with the matured basal part. They become septate, and are separated from the base by a distinct septum. The mature conidiophores may also become sparsely septate. The attachment of the conidium to the conidiophore is very unstable. In some cases there is a membrane between the mature conidium and its conidiophore, which resembles a broad and short sterigma (Plate XI, Figs. 17 and 18).

EXPLANATION OF PLATES.

Plate XI.

Fig. 1. Peach leaf infested by *Cercospora circumscissa*, Sacc., natural size and showing about forty-five points of infection. The circular pieces of dead tissue have fallen out in several places. The leaf was taken in October from a tree immediately adjoining a badly infested almond tree. Orchard of J. S. Baldwin, Orange, Cal.

2. Almond twig, new growth, infested by *C. circumscissa*, Sacc. From orchard of J. S. Baldwin, Orange, Cal. Natural size.

3. Almond twig, old wood (?), magnified 2½ diameters; *a*, the oval disk of tissue killed by the fungus; *b*, central, lighter, conidia-bearing portion; *c*, the fascicles of conidiophores; *d*, *d*, large portion of the side of the twig, probably indirectly killed by the fungus.

4. Transverse section through an almond twig partially killed by *C. circumscissa*, Sacc., enlarged 16 times; *a*, pith cells; *b*, xylem and xylem rays; *c*, phloëm and phloëm rays; *d*, cortical parenchyma; *e*, epidermis; *f*, cortical parenchyma killed by the parasite; *g*, fruiting bodies of the parasite; *h*, cambium tissue and xylem rays destroyed.

5. Almond leaf affected by the fungus, natural size.

6. Small portion of an affected almond leaf, magnified 3½ diameters; *a*, disk affected by the fungus; *b*, somewhat lighter, conidia-bearing center; *c*, crescent-shaped space left by the shrinking of the infected tissue; *d* and *e*, spaces where the tissue has been excised through the action of the parasite.

7–8. Transverse section of an affected spot in an almond leaf, showing the curvature of the tissue and the contained and protected fruiting bodies.

9–17. Conidia and conidiophores, the former in various stages of growth. The conidium at Fig. 17 is mature and separating from its conidiophore, showing at its base a vesicular membrane or sterigma occasionally observable. A large number of conidiophores of many forms, the straight, shouldered-curved, and more or less dentate forms are here shown.

18–29. Various forms of mature conidia, from those of 2 cells (Fig. 26) to those of 5 cells (Figs. 23 and 27). One bifurcate conidium is shown in Fig. 29.

30. Section of infested almond leaf, showing the fascicle of conidiophores resting on an indistinct, tubercular base, from which arise at least two hyphæ. The cells of the leaf are much shrunken and some of them are out of place, owing to the efforts made to free the mycelium from the tissue.

Plate XII.

Figs. 1–3. Conidia of *C. circumscissa* prior to germination; *a*, enlarged extremities of the spores prior to germination, and showing the clear spot seen before the pushing out of the germ tube.

4. Conidium of 4 cells with newly formed germ tubes at *a a*.

5–9. Conidia of 2, 4, and 5 cells, with one or more germ tubes, unbranched and of various lengths. Figs. 6–9, *a*, show the gathering of the cell contents at the ends of the cells and the numerous refractive bodies found there at the time of germination or before.

10. Conidium of 5 cells after germination from the end cells; *a*, retracted condition of the equatorial portion of the cells just prior to germination.

11. Conidium of 5 cells with 2 germ tubes; *a*, a germ tube arising from the central cell at the angle between the lateral wall and the transverse septum.

Figs. 12. Conidium of 4 cells and 3 germ tubes; *a* and *b*, germ tubes arising directly from the side of the conidium.

13. Conidium of 3 cells and 2 germ tubes; *a*, *b*, branches arising from a germ tube near its base.

14–16. Three conidia previous to germination; turning in part to one side, and thus nearly separating the cells and causing them to stand at an angle to each other; *a*, *a*, *a*, points in the partly separated cells where the cell wall is not hardened and where the germ tubes usually arise.

17. Conidium of 3 cells having 2 germ tubes with its cells turned to one side, admitting of the germination of the central cell from the septum.

18. Conidium of 4 cells; *a*, 2 cells turned at right angles to the remaining 2; *c*, the outer cells of both *a* and *c* have already germinated; *d*, points where the germ tubes of the two interior cells should push out, the tube from one of these having already appeared, *b*.

19. Conidium of 3 cells and 4 germ tubes, *a*, *b*, *c*, *d*; *a*, germ tube arising from the inner end of a terminal cell.

20. A 5-celled conidium with two long, unbranched germ tubes extending at right angles to each other.

21. A conidium of 3 or 4 cells having 3 rather long, unbranched germ tubes.

22. A conidium of 3 cells and 3 germ tubes.

23. Interior germination. An inner cell has pushed out a germ tube, *a*, into and through the end cell of the conidium.

24. Conidium with several germ tubes, some septate and some branched.

25, 26. Conidia showing septate germ tube and branch. 25, *a*, septa; 26, *a*, branch.

27. Conidium with germ tube, showing many septa and branches. *a*, branches.

Germinations obtained in moist cultures. All figures enlarged 800 diameters.

Plate XIII.

Fig. 1. Conidiophores of *Cercospora circumscissa*, Sacc.; *a*, tubercular mass of thick-walled cells just beneath the cuticle of the affected almond leaf, *d*, supported by the mycelium, *c*, and bearing the conidiophores, *b*.

2. Two mycelial hyphæ, *a*, *a*, connected with the thick-walled storage cells, *b*, supporting the conidiophores, *c*.

3–7. Various portions of the conidia-bearing organs, similar to those of Fig. 2; letters as in Fig. 2.

8. *a*, First conidiophores, with dark heavy wall; *b*, a secondary or later growth from *a*, which is shouldered, *c*, and bears at the curved tip a forming conidium, *d*; *e*, septum.

9. Secondary conidiophores, *a*, *b*, bearing conidia, *c*, *d*; *e*, *f*, points of attachment of two conidia to the single conidiophore; *f*, shouldered attachment; *e*, special attachment.

10. Fascicle of conidiophores, *a*, having thick dark walls and mostly shouldered or curved, with a secondary terminal growth, *b*. This terminal growth may or may not be septate beyond its point of origin, and is most commonly produced where there is much moisture.

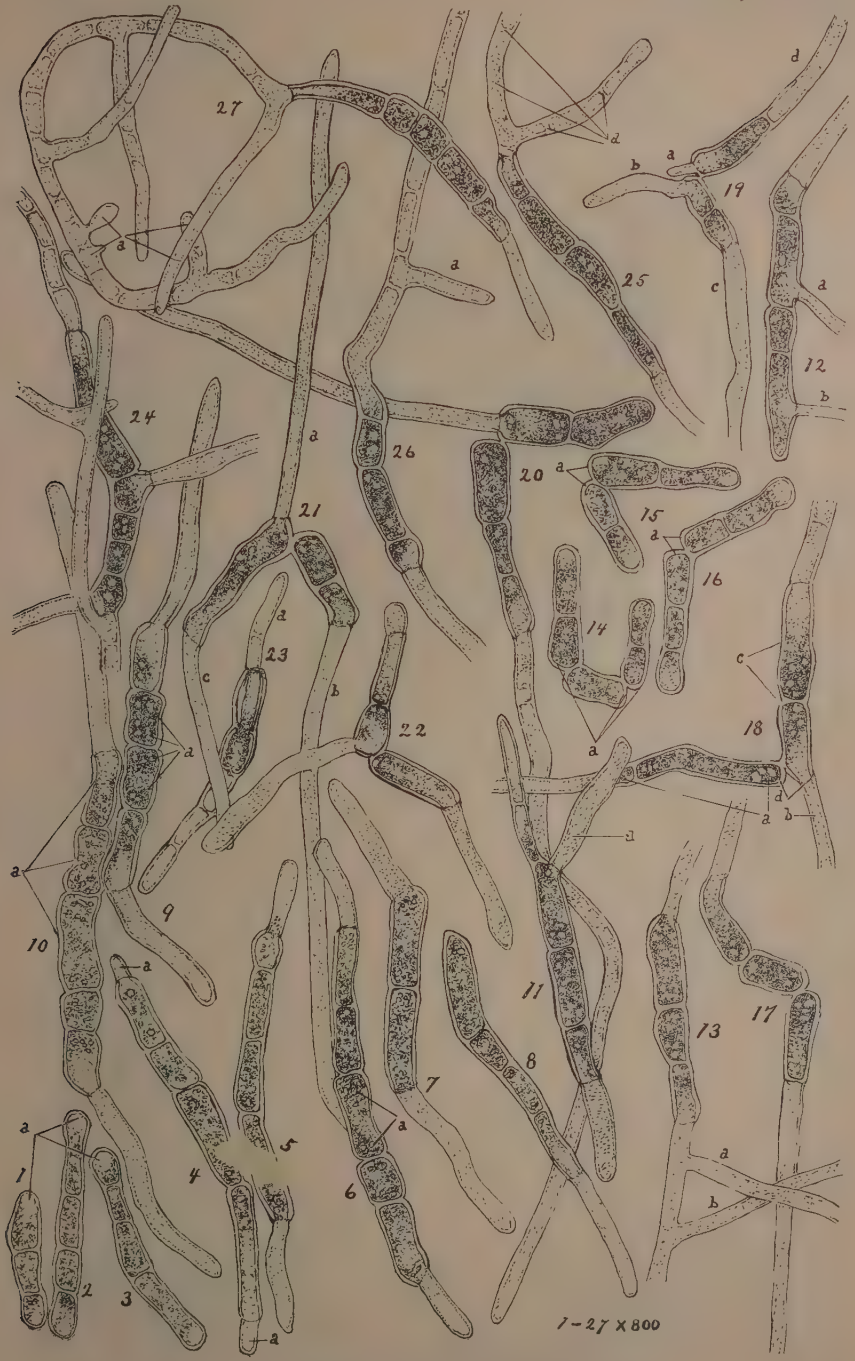
11. Upper view of conidiophores.

12. An old fascicle of conidiophores, showing the twisted and distorted forms which they often take after having produced conidia.

13. Fascicle of conidiophores, *a*, with numerous attached conidia, *b*. This shows that the distal portion of the conidium is that having the reduced diameter.

All figures from nature. Figs. 1–6 and 8–12 magnified 800 diameters; Figs. 7 and 13 magnified 600 diameters.

PIERCE ON ALMOND DISEASE.



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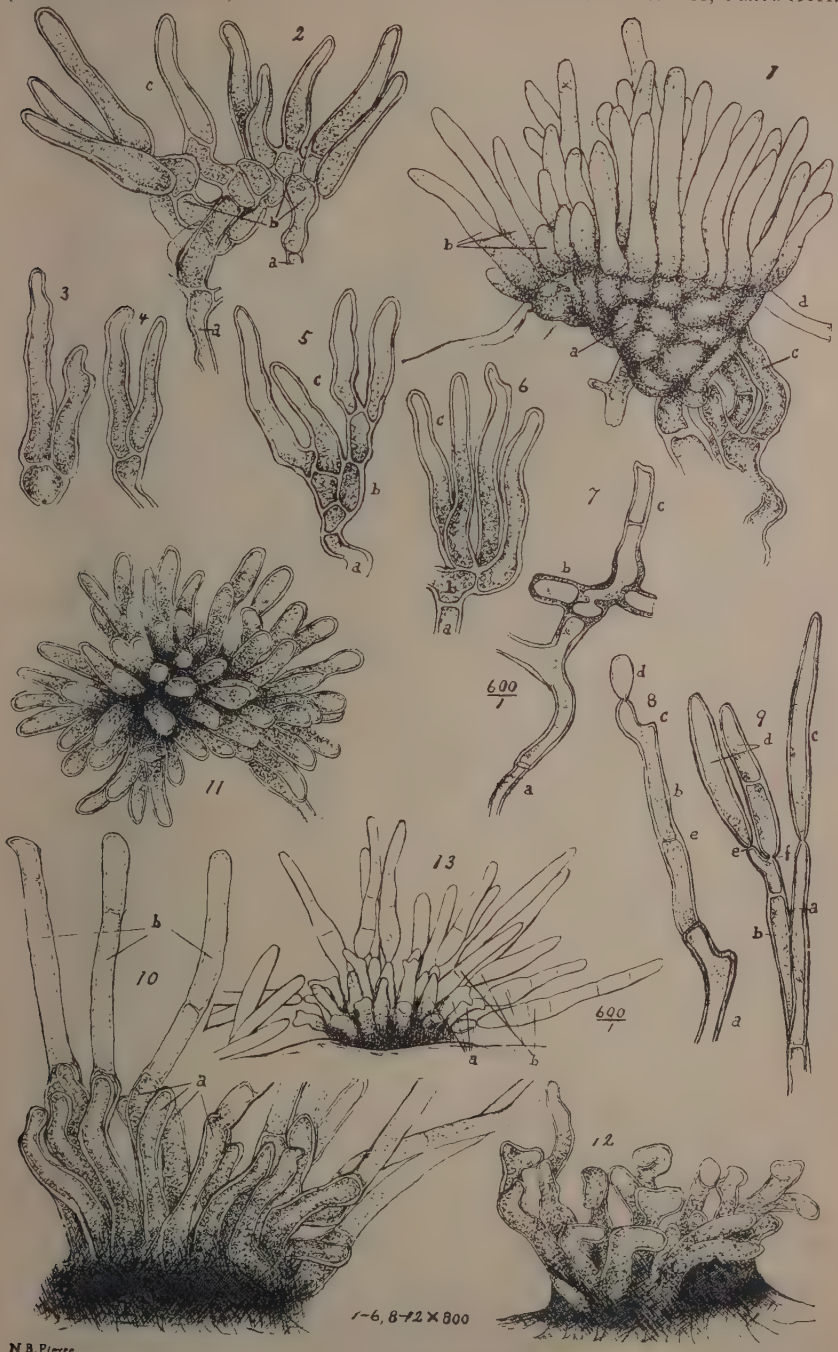

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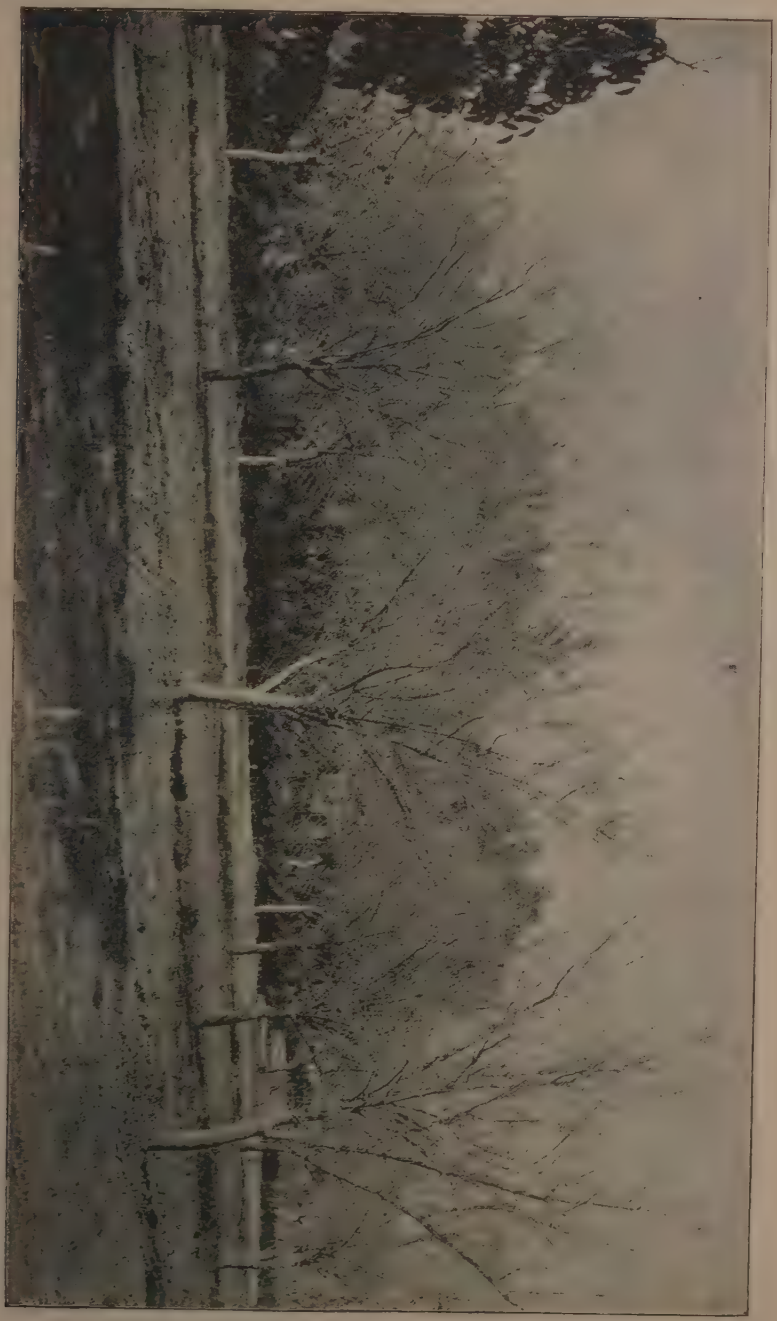

ALMOND ORCHARD DEFOLIATED BY CERCOSPORA.

PLATE XIV.

An almond grove near Orange, Cal., prematurely stripped of leaves during July, 1891, through the action of *Cercospora circumscissa* Sacc., combined with the lack of sufficient moisture. Many terminal twigs of last year's growth are dead and dry. From photograph, August 5, 1891.

SUGGESTIONS IN REGARD TO THE TREATMENT OF CERCOSPORA CIRCUMSCISSA.

By B. T. GALLOWAY.

As stated by Mr. Pierce, no experiments of consequence looking toward the prevention of the disease under consideration have been made in this country. Some work, however, along this line has been undertaken in Australia, while a number of diseases of a similar nature are successfully treated every year in the eastern part of the United States. From these facts and from the life history of the fungus causing the almond disease, which Mr. Pierce has so fully set forth, we are able to make some suggestions in regard to treatment. In the first place it must be borne in mind that the foliage of the almond and peach is easily injured by both fungicides and insecticides. Bordeaux mixture, which we use successfully in combating various diseases of the pear, cherry, and quince, and which never injures the foliage of these plants, under certain conditions has been known to sometimes kill the leaves of peach trees and even in some cases to destroy young wood, fruit, and flowers. In our experience the ammoniacal solution of copper carbonate has proved the safest and best fungicide for the peach and almond. The formula we shall adopt in all our work the coming season is as follows:

Copper carbonate	ounces..	5
Aqua ammonia (26°)	pints..	3
Water	gallons..	45

The copper carbonate should be placed in an ordinary wooden pail and just enough water added to make a thick paste. Then pour in the ammonia and stir until all the copper is dissolved. If 3 pints of ammonia is not enough to thoroughly dissolve all the copper add a sufficient quantity to bring about this result. When completely dissolved pour the copper solution into a barrel holding 40 or 45 gallons, then fill the barrel with water. Where there are a large number of trees to treat we find it very convenient to prepare the concentrated ammoniacal solution in advance. This can be done at leisure, taking care always to put the liquid into a tightly corked jug or demijohn as soon as it is made. When ready to spray take the concentrated fluid into the field and for every three pints add 45 gallons of water.

In order to protect the foliage from the attacks of the *Cercospora* it would probably be best to begin the application of the ammoniacal so-

lution just as soon as the leaves appear. A second application should be made in ten or twelve days, followed by a third two weeks later. It is possible that three applications would hold the disease in check. Doubtless six or seven sprayings would be better and would pay in the end; three sprayings should be made as directed above, the others thereafter at intervals of two weeks. For applying the solution a good strong force pump provided with two lengths of discharge hose and two spraying nozzles is necessary. Any good force pump will answer, providing it is light and strong and the working parts are made of brass. We usually mount the pump on a barrel and attach two pieces of one-fourth inch cloth insertion hose, each about 15 feet long. At the end of each hose we fasten an improved Vermorel nozzle. About 2 feet of the hose is then wired to a piece of cane fishing rod, 8 or 10 feet long, allowing the nozzle to project an inch or two beyond the pole. The barrel and pump are then placed in a wagon while a man standing on the ground at each side of this outfit manages the nozzles. Another man stands in the wagon and in addition to looking after the horses does the pumping. By means of the long hose and poles the spray may be quickly directed over a tree on each side of the wagon. Two trees being sprayed in this way the horses are driven opposite two more trees when the spraying is again repeated. In this way a large orchard may be treated in a comparatively short time.

For trees from 12 to 15 feet high it will require about 1 gallon of the solution for each application. With an apparatus such as we have described a tree may be sprayed in one and a half or two minutes. Estimating the cost of the team and men at $6 per day, the copper carbonate and ammonia at 40 and 8 cents per pound respectively, each tree should be sprayed six times for 10 or 15 cents. The cost may be still further reduced by making the copper carbonate at home. Directions for doing this were published by us in Farmers' Bulletin No. 4, but for the benefit of Californians who may not have seen this publication, we give below the formula:

In a tub or barrel dissolve 6 pounds of copper sulphate in hot water. In another suitable vessel dissolve 7 pounds of sal soda in hot water. When the two solutions are cool, pour the second slowly into the first, then add water until the tub or half barrel is full. Stir the solution thoroughly and let it stand for twenty-four hours, then siphon off the clear liquid and add fresh water. Stir again, and again allow the solution to stand twenty-four hours; siphon off the clear liquid as before, then remove and dry the sediment, which is carbonate of copper. Using the above quantities of copper sulphate and sal soda there will be formed 2½ pounds of copper carbonate. Sal soda sells at wholesale for 1½ cents per pound, so that on this basis the necessary chemicals to make 2½ pounds of copper carbonate will cost 46½ cents, or 18⅝ cents for 1 pound. The usual wholesale price for this chemical is 40 cents per pound.

It will be seen that it will not be costly or difficult to carry out the foregoing suggestions. It is to be hoped, therefore, that the treatment will be tried at least sufficiently to obtain some definite information on the subject.

CLUB-ROOT IN THE UNITED STATES.

By A. C. Eycleshymer.

(Plates XV, XVI.)

Since the disease club-root is forcing itself more and more upon the attention of American agriculturists, it is of the utmost importance that all the facts, at present known, concerning this destructive disease should be brought together, that the best means for its prevention may be suggested. With this end in view, a series of inquiries was addressed by the writer in 1889, to practical gardeners throughout the United States, and also to the officers of experiment stations and others likely to be able to give information regarding distribution, cause, remedies, etc. At the same time experiments were carried on in the hothouse, seedlings of cabbages and turnips being raised under conditions favorable for the development of the parasite and infected by mixing portions of diseased turnips with the soil. The correspondence and experiments were continued during two seasons. The results are communicated in the following preliminary report, as the work for the present has been interrupted, so that the series of experiments undertaken can not be completed.

The origin of the disease is not known. Its existence in Scotland was first detected in 1780, but little damage was caused until 1820. This is the earliest knowledge we have of the disease. It is at present known in England, Scotland, and Ireland, as anbury, anbury, hanbury, and fingers-and-toes. In Russia, kapoustnaja kila. Germany, kohlhernie. Belgium, vingerziekt. France, maladie digitoire. In the United States it is known by the various names, club-foot, club-root, clump-foot, and clubbing.

Its distribution in the United States is quite difficult to ascertain. There is no doubt, however, that its stronghold at present is in the New England and Middle States, especially in Connecticut, Rhode Island, Massachusetts, New Jersey, Delaware, and in the southeastern portions of New York and Pennsylvania. From this region it has extended southward through Maryland and Virginia to the Carolinas. The disease has occurred in Missouri, Illinois, Wisconsin, Iowa, and Michigan. Beyond the regions just named there is not sufficient evidence of its appearance.

The amount of damage caused by the disease is enormous. Woronin estimates the loss in the vicinity of St. Petersburg, Russia, for the year 1876, at $225,000. In the United States, wherever the disease is prevalent, it is considered one of the worst enemies of the market gardener, destroying in many cases the entire crop.

The plants affected are for the greater part confined to the genus *Brassica*, including the cabbage, cauliflower, turnip, and rutabaga. Halsted has recently described it as occurring on the radish. In Russia it also affects the genera *Matthiola* and *Iberis*.

The disease attacks the young seedlings and generally shows itself in from three to five weeks. It is first indicated externally by the so-called "flagging" of the leaves. The chlorophyll no longer shows the dark green color characteristic of perfectly healthy plants, but a lighter and yellowish tinge. Upon examining the roots of the plants thus affected there are found tubercular outgrowths or excrescences varying in size, according to age, from those scarcely distinguishable to those ten or twelve times the diameter of the normal root. These swellings seem to be confined exclusively to roots, never occurring on the stem or leaves.

Under the various names by which the disease is known probably many tubercular swellings have been described which bear no relation to true club-root. Buckman[7],* for example, says: "Every field, whether of parsnips, carrots, or turnips, will contain roots affected with finger-and-toe," and claims this to be a reversion to their original wild form, but he has evidently given a description of the digitate appearance as distinguished from the smooth unbranched condition of well-developed specimens.

So closely do the characteristics resemble those present on the roots of the potato, tomato, and parsnip caused by a nematode that one would consider them, from a mere casual examination, to be identical. In speaking of these galls Atkinson[3] says: "In external appearance the enlargements of the roots of the Cruciferæ, which are called club-foot, very much resemble the root galls. Unless one was pretty certain of the locality from which the diseased specimens came, it would be venturesome to undertake to say whether it was root gall or club-foot."

Another form of tubercular swelling is that found on various specimens of Leguminosæ (clover, beans, peas, vetches, etc.) described by Ward[32], Brunchorst[6], Schindler[20], Tschirch[3], Prazmowski[23], Beijerinck[4], and others. Since there is considerable variation on the roots of different species, there might arise some difficulty in distinguishing these from club-root. Seignette has recently described swellings probably due to variation of temperature. The fact that various forms of excrescences on roots are plainly due to widely different causes indicates the necessity of discrimination in order to avoid confusion.

Careful examination of the outgrowths occurring on the roots and rootlets of the genus *Brassica* show the elongated, fusiform swelling to be more characteristic of those occurring on the cabbage (Plate XV, Fig. 1), while those on the turnip are round or oval (Plate XV, Fig. 2). Extended comparison of diseased turnips and cabbages give no support to the view of W. G. Smith that the cause of the disease can be predicted from the form of the swellings. To the unaided eye these outgrowths, especially in the earlier stages, do not seem to differ either

* The numbers given after authorities refer to the bibliography at the end of the paper.

internally or externally from the sound tissue. In the later stages there is a change from pearly white to a yellowish brown. Instead of a smooth convex outline the surface is full of fissures, secondary fungi gain access, decomposition begins, and the foul odor arises which is so characteristic of the disease. These appearances are especially noticeable in the turnip. (Plate XV, Fig. 3.)

In the study of the minute anatomy use was made of freehand sections. Serial sections were also used to a considerable extent, the material being embedded in celloidin and cut with the microtome. Sections through stem and leaf show no trace of any parasite. If a transverse section of one of the spindle-like swellings of the cabbage be cut along the line *a*, *b* (Plate XV, Fig. 4), where the hypertrophy is least marked, and examined with a low power, a more or less mottled appearance is seen (Plate XV, Fig. 5). This is due to the presence of the parasite *Plasmodiophora brassicæ*, Wor.[37], which is undoubtedly the principal cause of the club-root disease. A very noticeable feature is that, in general, this appearance is found in the vicinity of the cambium *c* and tracheæ *tr* of the axial portion. Examination with a higher power shows this mottled appearance to be due to the presence of minute spherical bodies, which are so densely packed that the entire lumen of the cell is filled. Sections of the turnip along the line *a b* (Plate XV, Fig. 6) show different stages in the development of the Myxomycete. There is often found in the same section all the transitional stages between the plasmodium and mature spores (Plate XV, Fig. 6[a] *a*, *b*, *c*). The individual cells of the thin-walled parenchyma undergo a marked hypertrophy. This is shown by comparing Figs. 7 and 8. The drawings are made from the same section taken along the line *c d* of Fig. 6, Plate XV. Fig. 7 shows the normal tissue of the cambium zone taken from the right side, while Fig. 8 shows the pathological condition as it occurs on the opposite side. If the peripheral layers *a* be made to coincide, a comparison is readily made. Moreover, this swelling is noticed in cells surrounding those infected and where no trace of the parasite could be found. Yet this is not sufficient to account for the enormous tubercles shown in Plate XV, Figs. 1 and 2. This would seem to justify Woronin's[37] statement that the swellings are not only caused through the hypertrophy of individual cells, but also by an increase through cell division. The tracheæ apparently undergo no changes. Plate XVI, Fig. 9, taken from a section along the line *a b* of Fig. 10 shows one of the vessels more highly magnified. It is completely filled with the plasmodium, while the surrounding tissue is free from any trace of disease. This at once suggests that the parasite may thus be readily carried to different parts of the tissue. If now the contents of the cells of the medullary rays be examined they are found, in the normal tissue, to be loaded with starch. Comparing the pathological tissue from the same region a marked change is noticed. Instead of the small cells well stored with reserve food, we have the

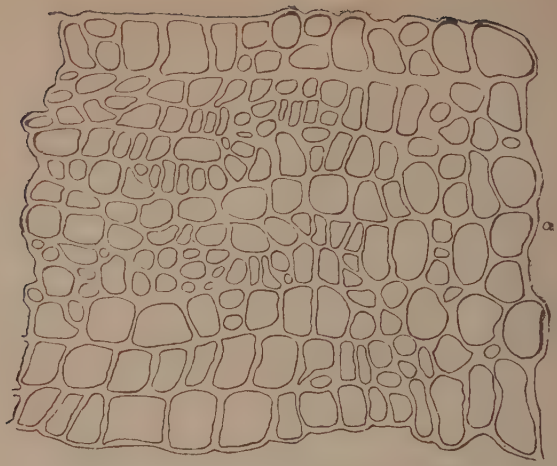

FIG. 7.—Transverse section along line *cd* of Plate XV, Fig. 6. The portion represented is taken from the normal tissue found on the right side, × 200.

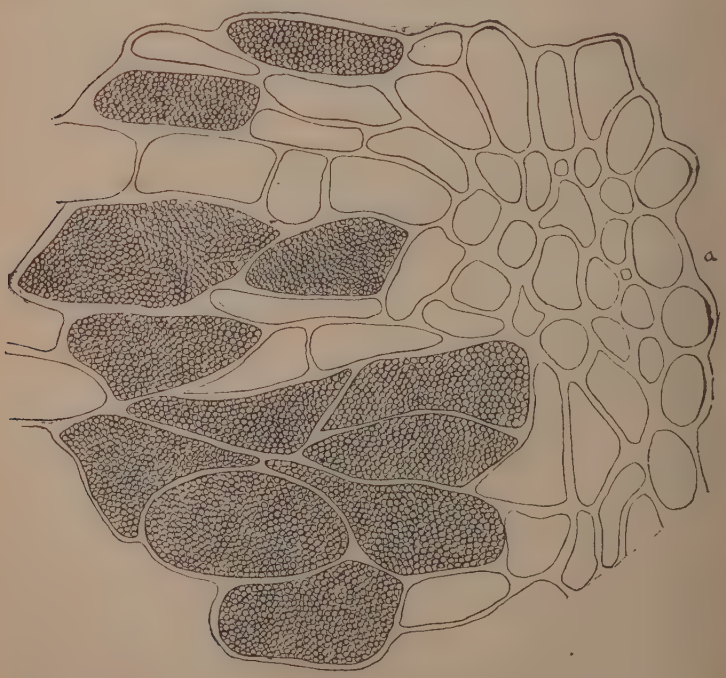

FIG. 8.—Transverse section along the same line *cd*, but taken from the left side, × 200.

enormously swollen cells shown in Plate XV, Fig. 6ª, in which there is no trace of the starch, *i. e.*, so far as could be determined by the use of iodine. Testing with Schulze's solution, or hydrochloric acid and phloroglucine, a lignified condition of the cell walls is found, though to a less degree than in the regions where the cells are entirely filled with spores. Often the cells of the cambium are so pressed out of shape that the tangential walls alone are distinguishable.

If a bit of the tissue, in which spores are found so abundantly, be placed under a cover glass and lightly tapped the spores are set free. If the slide be now placed in a moist chamber and allowed to remain from four or five to twenty-four hours, the swarm cells are distinguished either on the slide (Plate XVI, Fig. 11), or escaping from the spores (Fig. 12). The appearance of the swarm cell after escaping is that of an irregular protoplasmic mass which undergoes greater or less changes in contour. Plate XVI, Fig. 11 *a*, *b*, *c*, *d*, *e*, *f*, *g*, represent the changes of outline through which one of the swarm cells passed in about fifteen minutes. A very much elongated process, cilium, is often observed (Fig. 11*a*). The nucleus is often plainly visible (Fig. 11*e*, *f*). Nothing could be determined as to nuclear changes. It seems fair to suppose, however, that these correspond to what has been observed in other Myxomycetes. It is in this stage of its existence that the organism is supposed to penetrate the root hairs, and thus gain access to the deeper parts of the cortex. Repeated endeavors were made by means of slide cultures to observe the penetration of these swarm cells, but without success. This is a point that needs further observation. The penetration has never been observed, and it is possible that it is through ruptures in the tissue, caused by insects, worms, or other forms, which are constantly present in the soil. If the slide be kept in a moist chamber for four or five days, other and larger forms are present (Plate XVI, Fig. 13), while the swarm cells have almost entirely disappeared. It is quite probable that the larger forms result from a fusion of the swarm cells, but direct proof is wanting. These forms undergo the same changes of outline as described for the swarm cell (Plate XVI, Fig. 13*a*, *b*, *c*, *d*). A nucleus is plainly visible and a pulsating vacuole is present. It is worthy of note that in the tissues these forms are never observed, while in slide cultures they are very abundant. Another condition observed is represented in Plate XVI, Fig. 14, and may be designated as an early plasmodial stage. In most cases it does not at first fill the entire lumen, and more or less branching filaments extend to the walls of the cell, often apparently continuous with the plasmodium of the adjoining cell. It often presents a somewhat aggregated appearance (Plate XVI, Fig. 14). Vacuoles are always present. They are, however, of a decidedly different nature from those found in the forms represented in Plate XVI, Fig. 13. In that, no pulsation is observed. Nuclei can not be observed by the use of ordinary nuclear stains; acetic methyl green; picric aniline blue; acetic carmine, etc. The absence of starch in all cells occupied by plas-

modia leads one to strongly suspect it has been digested by the mass. Dr. Wortman performed experiments which seem to show conclusively that the plasmodium of Fuligo took in and digested starch grains. It is highly probable that the same takes place in the plasmodium above described. In this would be found an explanation of the fact already referred to, that in the medullary rays of diseased parts no trace of the starch can be found.

Passing to stages which are probably later, since they occur in tissue where ripe spores are very abundant, the plasmodium is found filling the entire lumen of the cell and presenting a reticulated granular appearance (Plate XV, Fig. 6ª *a*). Another appearance often noticed is represented in Fig. 6ª *b*, where the granules have an aggregated aspect. These are probably changes immediately preceding spore formation, Fig. 6ª *c*. A very peculiar appearance of the plasmodium is shown in Plate XVI, Fig. 15. The significance of this is unknown. A possible explanation might be the irritation caused by the presence of bacteria, but a series of transitional stages between those indicated in Plate XVI, Figs. 15 and 16, were observed.

The ripe spore is composed of a thin, transparent, refractive outer portion inclosing a more or less granular matrix, in which are embedded bodies of varying size, form, and refractive power (Plate XVI, Fig. 12). The nature of the bodies could not be determined; they may be nuclei or oil globules. From each of these spores a swarm cell escapes into the soil, where it may come in contact with the rootlets of the young plant.

Among cabbages, and in fact all members of the genus *Brassica*, there seems to be no variety exempt from attack. Many varieties were sown in the same soil under similar conditions, and so far as could be determined no differences were present. From correspondence the same conclusion is reached. It is claimed that the rutabaga is less liable to attack than the common variety, and when sown in alternate drills with "purple top" they produce a fair crop, while the latter is much affected. As to the variety of radishes attacked, no information is at hand. It is now generally conceded that the disease occurs after all kinds of crops. The market gardeners consider it dangerous to grow cabbage or turnip crops on the same ground for even two successive years. Rotation is absolutely necessary. After a cabbage or turnip crop all débris should be carefully removed and burned.

It has been claimed that early sowing was the cause of the disease. While this is untenable, there is undoubtedly a great tendency for early sown crops to become infected, especially if the season be a wet one, thus making the conditions for the germination of the spores more favorable. The disease is said to be more prevalent along trodden paths indicating that the rolling of ground is unadvisable.

There can be no doubt that the disease is propagated to a considerable extent through the decayed material left on the field. Yet one is puzzled to account for the well established fact that it is found occa-

sionally on newly broken ground where no crop has ever yet been grown. This would seem to indicate that certain soils harbor the organism as a saprophyte. Poorly drained ground often shows the same tendency. The soils otherwise best adapted for cabbage growing are those on which the organism can survive best, *e. g.*, bogs and swamps which are rendered arable, but crops grown on sandy loam are less subject to the disease, as are also those grown on calcareous soils. Wherever a limestone formation outcrops both cabbages and turnips are comparatively free from attack. Some of the Long Island gardeners raise cabbages season after season on the old shell heaps without any trace of the disease.

It often occurs that turnips or cabbages grown on ground previously covered with compost heaps show the disease, while the plants all around them are free. Fertilizers should not be spread over the ground in the autumn, since it is known that the various kinds of manure form an excellent substratum for the development of certain Myxomycetes. If applied, it should by all means be thoroughly fermented.

It is quite evident, from the nature of the disease, that after having gained access there is probably no cure. Preventives are apparently the only means by which the ravages of the disease may be averted. Probably the want of clean cultivation is one of the most fruitful sources by which the disease is propagated. Of all the various preventives, ashes, salt, chalk, lime, bisulphide of carbon, etc., suggested by both gardeners and scientists, lime seems to be the most effectual. If applied to the land during the spring immediately preceding, it very seldom has any effect on the ensuing crop, but if applied a year and a half before, it almost invariably has a surprising effect in preventing the disease. It is only by extended experiments that the best methods of application can be determined. Since many believe the disease originates largely in the hot-bed before transplanting, sterilization of the soil should be tried. Mixing certain proportions of unslaked lime with the soil used in the hotbed will undoubtedly modify, to a considerable extent, the occurrence of the disease. Hulst[16] makes a saturated aqueous solution of chloride of lime, sold by druggists as "bleaching powder." This solution is diluted with three parts water and applied to the roots of the plants and to the surrounding soil at the time of transplanting. In from two to three weeks this is followed by a second application.

In conclusion, I wish to call attention to certain forms that are almost constantly present. Sections of tissue containing plasmodia are rarely examined in which there are not present minute bodies undergoing vibratory movements very similar to that known as the "Brownian movement." The granules are very large, and indeed so much do they resemble micrococci that one is led almost irresistibly to the conclusion that this is the explanation. If this be true it is questionable to just what extent we are dealing with true plasmodia. Ward[32] finds the so-called plasmodia described by various authors as occurring in the tubercles found on the roots of *Vicia Faba* to be nothing more than the pro-

toplasm of the cells, stimulated into increased activity by parasitic gemmules. While there is but little doubt that *Plasmodiophora brassicæ*, Wor., is the principal cause of club-root, it is by no means improbable that bacterial forms play quite an important part. Pure cultures should be made of the various forms so generally present and inoculation experiments tried.

I hereby desire to acknowledge with sincere thanks the assistance I have received through the kindness of Prof. Spaulding, under whom the work was begun and has been carried thus far. I am indebted to Dr. Erwin F. Smith of the Division of Vegetable Pathology of the U. S. Department of Agriculture, to Dr. Byron D. Halsted of the New Jersey Experiment Station, and to Mr. George A. Schultz, of Jamesburg, N. J., who kindly furnished me with material. To the botanists of the various experiment stations and other correspondents, whose suggestions have been of much value, I am also under obligations.

UNIVERSITY OF MICHIGAN, *February 14, 1891.*

BOTANICAL LABORATORY.

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EXPLANATION OF PLATES.

PLATE XV.

Fig. 1. Specimen of diseased cabbage, after Woronin. Natural size.
2. Specimen of diseased turnip root, after Sorauer. Natural size.
3. Portion of transverse section of turnip. Natural size.
4. Rootlet of cabbage showing condition seven weeks after infection. Natural size.
5. Transverse section of rootlet along the line *ab* in which the spores are present, × 65.
6. Portion of root of turnip seven weeks after infection. Natural size.
6*a*. Cells from tranverse section along line *ab* Fig. 6, × 200.

PLATE XVI.

Fig. 9. Vessel from axial portion. Section taken from along line *ab*, Fig. 10, × 600.
10. Diseased rootlet of cabbage. Natural size.
11. Swarm cell drawn at short intervals to show constant change in outlines, × 1,200.
12. Ripe spores from some of which swarm cells are apparently escaping, × 1,200
13. Probably early stages of plasmodia, × 600.

Fig. 14. Normal plasmodium as found in early stages of the disease, × 600.
15. Aggregated appearance of plasmodium × 300.
16. Section showing another aggregated appearance in which the spherical masses are much smaller, × 200.

FIELD NOTES, 1891.

By Erwin F. Smith.

It can scarcely be doubted that climatic conditions exert a marked influence on the spread of many fungous diseases. Bad weather may render the host more susceptible, or only afford the parasite increased facilities for multiplication, or both. Under just what set of conditions in particular cases the fungus is most likely to attack the host, or is certain to do so, are points on which, for the most part, there is not yet enough evidence to decide positively, but as time goes on we may confidently expect to see many of these problems worked out fully, our knowledge of the complex relations of host and parasite being yet only in its infancy.

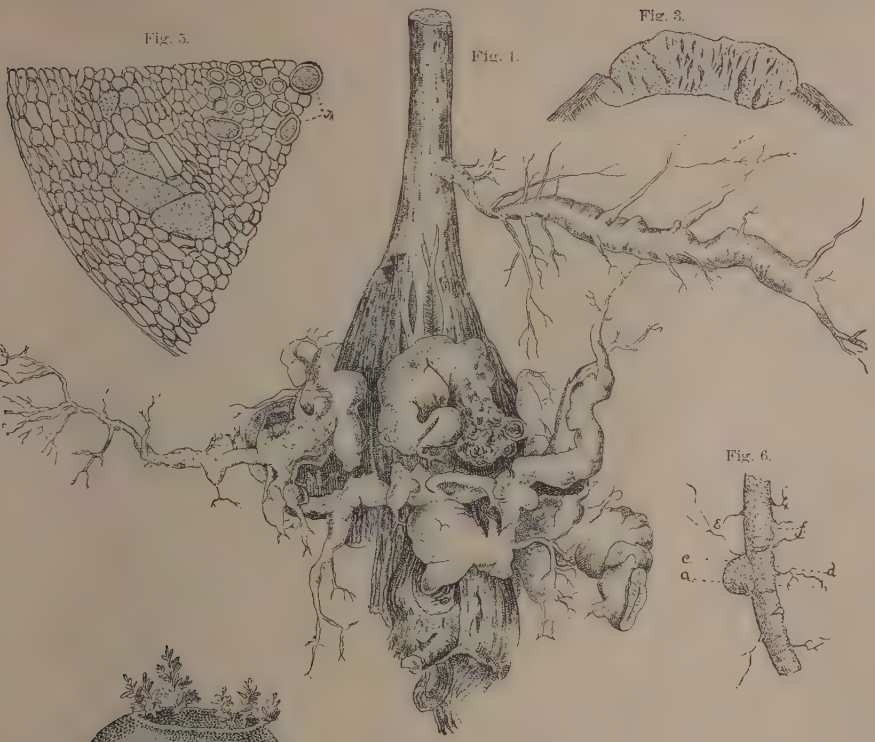
In this series of notes my desire is simply to put on record certain observations which may contribute toward the solution of a most interesting problem of phytopathology. There is no doubt that mycologists must become closer observers of local weather conditions and of the individual, varietal, and specific peculiarities of plants, if they would satisfactorily explain the behavior of many fungous diseases.

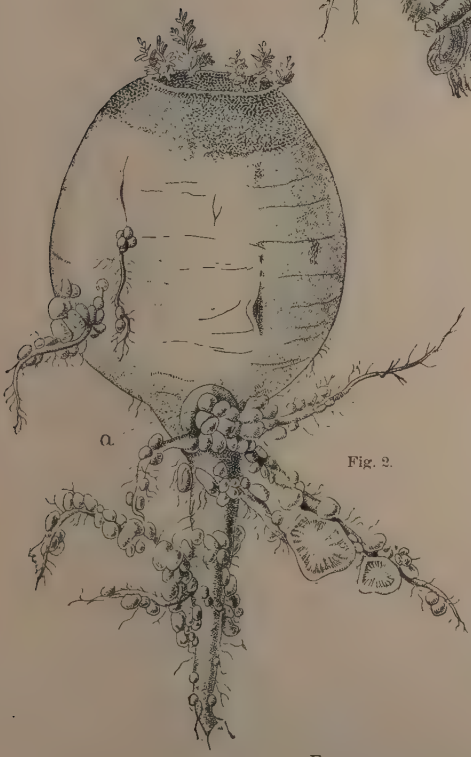
PEACH CURL.*

It is well known that gardeners and fruit-growers have frequently ascribed this disease (mildews, also) to the depressing influence of cold. Mycologists, on the other hand, since the discovery of Taphrina, have, perhaps too generally, assumed the direct cause to be the only necessary factor in the production of curl.

The conditions under which peach curl appeared in the orchard of Mrs. W. O. Shallcross, at Locust Grove, Md., in the spring of 1891, are so peculiar and bear so directly on the point at issue that it seems worth while to set them down somewhat fully. This orchard contains about 1,050 trees, now set five years. It is situated on the east side of Chesapeake Bay, on loose, thin upland, in a region of extensive orchards, the nearest being about one-half mile distant. Peach curl due to Taphrina is not troublesome in eastern Maryland or Delaware. It was present in quantity for the first time in many orchards in Kent County, in 1890, and was so much more than usually abundant everywhere as to receive notice in this Journal (Vol. vi, p. 107). Probably there was more or less of it in this orchard, but not enough to attract special attention.

* *Taphrina deformans* (Berk.), Tul.





EYCLESHYMER ON CLUB-ROOT.

Fig. 9.

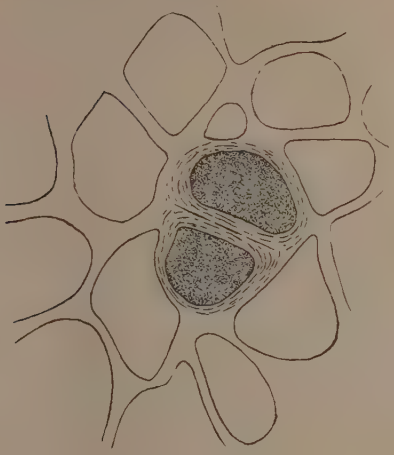


Fig. 10.

Fig. 11.

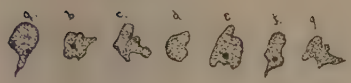


Fig. 12.

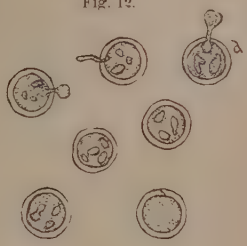


Fig. 13.

Fig. 14.

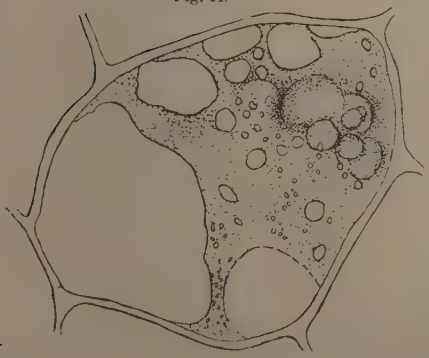


Fig. 15.

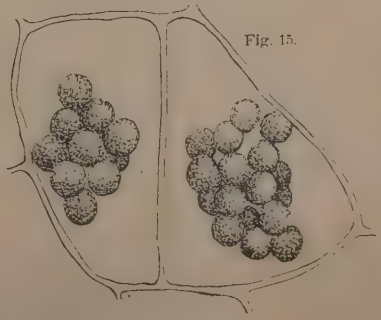
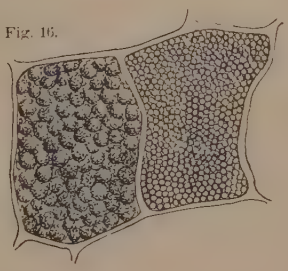


Fig. 16.



EYCLESHYMER ON CLUB-ROOT.

The orchard contains cases of peach yellows, and alternate strips have been under treatment since the autumn of 1889, and consequently the entire orchard has been subject to frequent inspection. The following examinations were made in the spring of 1891:

April 16 every tree was carefully examined in all parts above ground for symptoms of yellows. This was to determine whether any new cases had appeared since fall. The tentative diagnosis of new cases was based principally on the color and state of advancement of the unfolding leaves, and for this reason the inspection of the foliage of each tree was minute. The leaf buds had been open about two weeks, and some varieties were then in blossom. The weather for a week had been dry and pleasant.

April 20 the fertilizers were put on. The foliage was much larger than on the 16th and growing rapidly, influenced by warm weather and a heavy thunderstorm on the night of the 18th. The fertilizer was harrowed in on the 21st, but the orchard was not plowed until May 7. The application of the fertilizers consumed most of the day, during which I passed from row to row through all parts of the orchard seeing every tree. With one exception all the varieties were then done or nearly done blossoming, and the petals were on the ground.

April 23 the orchard was revisited and two strips were limed. Again many of the trees were examined closely. All varieties were done flowering and some forward fruits had begun to burst the "cap."

During these three visits I observed no trace of Taphrina. On the last visit the older leaves were 1–2 inches long.

May 1 I revisited the Shallcross orchard, and was surprised to find peach curl on nearly all of the trees. There were thousands of affected leaves, and the curl was the first object to attract attention. The orchard was visited to secure buds for inoculations, but the curl was so abundant that difficulty was experienced in finding cuttings free from it.

This great outbreak of Taphrina came upon the trees during the last week in April. The minuteness of the observations on April 16, 20, and 23 fixes the date beyond reasonable dispute. There was no noticeable curl prior to April 23, and the orchard was full of it from one end to the other on May 1.

Prior to the 24th the weather was warm for a whole week, and vegetation was tender and growing very rapidly. Following this and during the week in which the curl developed came a sudden cold wave of three days duration. On Thursday the 23d, the temperature reached a maximum of 80° F. On the 24th it dropped to 54°–64°; on the 25th it was 44°–64°; and on the 26th it was 40°–62°, with a slight frost in low places.* The next day it was warm again, the range being from 50°–80°.

*The minimum records are those of early morning (sunrise), and do not represent the lowest temperature of the twenty-four hours. All were recorded by Dr. W. S. Maxwell, Still Pond, Md.

This coincidence is suggestive, to say the least, and I am inclined to believe that the sudden drop in the temperature had something to do with this sudden and very unusual prevalence of the curl. Probably some other unknown factor also favored the development of the fungus in this particular orchard, *e. g.*, some soil condition. This is the more likely because no other orchard under observation was anywhere near so badly attacked.

PEACH MILDEW.*

This mildew has been found occasionally since 1887, but never upon many trees in any one orchard. It usually attacks the leaves and young stems. On the latter it forms a dense, felt-like, persistent hyphæ-complex which is first white and afterwards a dirty gray, the epidermis being cracked open and destroyed or much injured and a thick brown layer of cork being formed under the mycelial patches. The mildew produces conidia in abundance, but perithecia have not been found, although the search has been continued into winter.

In Maryland and Delaware particular trees are attacked year after year and become stunted, while surrounding ones escape. Often only one or two trees in an orchard will be attacked. This fact has been so noticeable during the last five seasons that it seemed probable the disease was brought from the nursery. Its persistence on certain trees and the freedom of others was only explainable on the hypothesis of some individual peculiarity which I was unable to discover.

This year the mildew was observed in Maryland, Michigan, and Georgia, and in central Michigan it was more than usually prevalent. At Hubbardston it attacked a dozen very thrifty seedlings in the fifth year of growth and apparently for the first time, defoliating the tops of the trees in June and July and causing a new growth of leaves and branches not unlike incipient hexenbesen. In this case the origin of the mildew is unknown, but in case of a Maryland tree known to have mildewed in 1889 and 1890, the fungus was found on the unfolding shoots so early in the spring and to such an extent as to make it almost certain to have wintered over in the form of perennial mycelium. Several hundred leaves and stems were covered with white mycelia and conidial fruits prior to the time of blossoming, and in some cases almost before the buds were open. No perithecia could be found on this tree and no mildew this year or last year on any of the neighboring trees. From other trees fresh looking mycelium has been taken in midwinter, and I have no doubt as to its perennial nature.

Later in the season Mr. J. W. Kerr, of Denton, Md., called my attention to four yearling peach trees which were badly mildewed, although they had been grown from fruits procured by cross fertilization and did not have the same parentage. The most conspicuous point of agreement was the absence of glands at the base of the leaf blade. Mr.

* *Sphærotheca pannosa* (Wallr.) Lev. (?).

Kerr stated that during a large nursery experience he had observed trees bearing leaves destitute of these large glands to be specially subject to mildew. Other nurserymen have observed the same fact, even as long ago as the days of Downing. This, in connection with the fact that mildew is rare in the eastern United States and that most of our orchard varieties possess glandular leaves, led me to make careful observations during the remainder of the year. The tree above referred to as attacked in early spring bore leaves destitute of glands.* So also the twelve at Hubbardston, Mich. In fact, frequent observations in the orchards of several States brought to light everywhere the same curious correlation. *Trees with gland-bearing leaves were free from mildew, and mildewed trees have leaves destitute of glands.*

One exception only in perhaps 150 cases was noted: a tree with slight mildew and traces of glands. The same correlation has also been observed, according to Mr. Wickson, in California. It would seem, therefore, as though peach trees of the type bearing glandular leaves are more resistent to this mildew than other varieties, but whether this will hold good for all localities and all varieties remains to be seen.

BLACK SPOT OF PEACHES.†

This disease was unusually prevalent on the Delaware and Chesapeake peninsula. Indeed, I have never before known it to be one-fourth as abundant. All kinds were attacked, even the early and midseason varieties which usually escape. Many fruits were very badly spotted and unsalable. Very often also the spots coalesced into broad patches covering one-third to one-half of the peach. The side attacked was dwarfed. The flesh under the black patches was unusually solid and ripened very slowly, remaining greenish and bitter when the other side was fully ripe.

The observations of this year confirm earlier ones and lead me to think that dry weather is not favorable to the development of this fungus. During the growth and ripening of the fruit, rains occurred at frequent intervals and there was no dry spell such as usually occurs. January, February, March, and the first week in April were also rainy, and the winter was mild; no zero weather.

FROSTY MILDEW.‡

This parasite evidently flourishes best in shady places. It was unusually common on the Chesapeake and Delaware peninsula in the fall of 1891, especially on trees bearing dense and late-ripening foliage. In previous seasons I have also noticed it most abundant on the foliage of highly fertilized trees, especially those given nitrogen or complete fertilizers and growing late into autumn. For example, in the same

* These glands secrete a fluid sought after by bees and other insects.

† *Cladosporium carpophilum*, Thm.

‡ *Cœnocorella persoon*, Sacc.

region in 1890 it was rare on unfertilized trees, but very common on those which received complete fertilizers, especially on the lower and inner leaves. The conidia develop on the under surface of the leaf, often in restricted areas visible above as yellow or yellowish green patches with definite margins. Very late in the season, before the fall of the leaves or afterward, pycnidia develop on the conidial surface and in the body of the leaf in such a manner as to lead one to believe them a part of the cycle of development. These were first observed in 1890 and again in 1891. Other bodies similar to the phoma conceptacles, but destitute of spores, accompany these, and a search toward spring would perhaps reveal the presence of ascospores, and might lead to the determination of the true position of this form-genus.

PEACH RUST.*

Puccinia pruni-spinosæ occurs but rarely in this latitude (39°), and then mostly on thickly planted nursery stock. In Georgia it is more abundant, but there also it appears to prefer nurseries to orchards. Last year and this year it did not attack the trees until after June. In a yard at Griffin a number of small seedlings were free from rust the 1st of last July and so badly affected when reëxamined in November that it was almost impossible to find a sound leaf. Most of the leaves bore dozens of sori. The upper surface of the leaf was either a uniform yellowish green or a bright green with sharply defined yellow spots corresponding to the sori on the under surface. As in another locality the preceding year, the leaves nearest to the earth were observed to be most badly attacked. The autumn of 1891 was very dry, the first rain of two months occurring on November 10. At Vineyard, Georgia, in 1890, it was also observed that the fungus spared the parent tree but attacked the foliage growing from buds which were taken from it and set into seedlings in another locality on June 23.

PEACH ROT.†

In eastern Maryland and Delaware it rained every few days during the peach season, and was frequently warm and cloudy between showers. In consequence the brown rot, due to *Monilia*, was very prevalent. The blight of blossoms and twigs has already been described in Vol. VII, pp. 37–38, of this JOURNAL. In some cases as many as twenty blighted blossoms were found on a single twig, but in spite of all accidents the peach crop above the frost line was enormous. The abundance of this fungus in 1891 contrasts strikingly with its rareness in 1890, when there was no fruit, and raises the question how it tided over the year of famine.

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* *Puccinia pruni-spinosæ*, Pers.

† *Monilia fructigena*, Pers.

PEACH YELLOWS.

This malady has been more than usually prevalent in parts of the eastern United States. There was great complaint of premature fruit in the mountains of western Maryland; on the upper part of the Chesapeake and Delaware peninsula; in portions of Pennsylvania and New Jersey; in Connecticut, and at Fennville, Mich., where they have neglected to remove diseased trees. The disease was also found for the first time at Ann Arbor, Mich. This is a profitable peach region, somewhat isolated from other peach districts of the State. Cases to the number of more than 150 were discovered in midsummer. They were in ten different orchards, and in one or two the evidence indicated that the disease had been present more than one year, probably two or three years. The disease seems to have broken out first in the orchard of J. D. Baldwin, in trees brought from New Jersey. Seventy-five diseased trees were removed from this orchard and forty-five from an adjoining one. All affected trees have been destroyed, and a vigorous effort will be made to prevent the extension of the disease.

Examinations in early spring of trees known to have been healthy the preceding autumn showed that it is possible to diagnose a certain number of cases before the trees blossom, but not all of them. The first symptoms of the disease may appear at any time from early spring to late autumn.

CLUBBED BRANCHES.

Complaints have been received from Michigan and New York of a nursery trouble which renders peach trees unsalable without permanently injuring them. The terminal buds are killed, and side buds push, giving to the top a branched, stunted, clubbed appearance, not unlike that occurring naturally in certain varieties, *e. g.*, of Hinman and Garfield. The injuries appear to be done in May or June, and specimens were received too late in the season to determine the cause. This trouble has been present in both States for at least two years. Whole blocks of trees may be affected. They are said to make good roots and to grow out of the trouble the following season.

In specimens sent in more recently from Ohio many of the secondary branches were much thickened at the base, very spongy, and easily compressed. A microscopic examination showed many dry cavities in the xylem cylinder and an almost complete absence of lignification, the characteristic stains with lignin reagents being confined to the vicinity of the pith and to a few scattered bundles of wood fibers. A large number of trees in the middle of a nursery were seriously injured.

STEM AND ROOT TUMORS.

Irregular, tuberform, rough, warty outgrowths on the stem and roots of the peach at or just beneath the surface of the earth have been unusually common in nursery stock this year. Specimens were collected

in the District of Columbia and middle Georgia, and were received from California and Missouri. Some of these growths were as much as 2 inches in diameter, *i. e.*, much larger than the stem itself. Sorauer reports similar swellings on apple and pear trees, and ascribes them to mechanical injuries.

PEACH ROSETTE.

This disease is on the increase in Georgia, and its contagious nature has been settled beyond dispute.* Root grafts have been made to determine whether the contagion exists in all parts of the tree or only in the top. Cross inoculations have also been made, peach on plum and plum on peach, to determine experimentally whether the peach and the plum rosette are identical. Other experiments are in progress.

PLUM BLIGHT.

This disease (see Vol. VI, p. 108, of this JOURNAL) has done less than the usual amount of damage in Georgia, but there have been some cases.

PEAR DISEASES.

The pear crop on the Delaware and Chesapeake peninsula was enormous and quite free from scab (*Fusicladium*) and the spot disease due to *Entomosporium*. Pear trees were in full bloom at Chestertown and Still Pond, Md., on April 19, and the first scab was found on May 3, when the young fruits were about one-fourth inch in diameter. Two hours search brought to light only twenty-five scabby fruits. During blossoming and immediately after, the weather was dry, and there were two cold waves, April 24–26 and May 4–6. The records of Dr. Maxwell seem to show that pear scab has been abundant whenever there has been a combination of wet weather and high temperature during and immediately following the time of blossoming, and not troublesome in other years. Should additional observations confirm this view, there is in it a hint as to the years when treatments for scab will be most necessary.

The first Entomosporium spots were found on the leaves April 21. The damage in Maryland and Delaware in 1891 was confined principally to the leaves. These fell so early that many orchards blossomed and renewed their foliage in late autumn. The leaves of the Kieffer pear were not injured. This variety is noticeably resistant.

With the exception of one orchard, there has been no pear blight† worth mentioning in the vicinity of Still Pond, Md., in five years. The large commercial orchards have been remarkably free from it. These

* Additional Evidence on the Communicability of Peach Yellows and Peach Rosette. Government Printing Office, Washington, D. C., 1891.

† *Bacillus amylovorus* (Burr.) De Toni.

consist principally of Bartlett, Howell, Duchess d'Angoulême, Lawrence, and Kieffer. Choicer varieties blighted badly in years past, and their cultivation was abandoned.

SYCAMORE BLIGHT.*

The Sycamore disease due to *Glocosporium nervisequum* appeared suddenly at Dover, Del., between May 6 and 14. A special examination of a large tree was made on the first date to discover the blight, because it had appeared on the tree in previous years. Not a trace was found, but having occasion to pass the same tree a week later, dozens of blighted shoots and dead and drooping leaves were found on all parts. Immediately preceding this attack came a cold snap. On the morning of the 4th there was a white frost, on the 5th it was very cold, with a black frost at night, which destroyed the peach crop on flat lands. On the 6th it was still colder with a fall of hailstones. Following this and during the week in which the blight appeared came a hot spell. It was very warm on May 9, 10, and 11.

NEW FUNGOUS DISEASES OF IOWA.

By L. H. Pammel.

The following paper treats mostly of new diseases of plants, but reference will also be made to a few that have been the subject of recent papers. Its scope will be limited to such diseases as have been destructive to farming and horticultural interests during the past year in Iowa, since to do justice to the subject over the whole country would take too much time and space.

The subject can naturally be divided as follows:

I. Fungi affecting forage plants and cereals.
II. Fungi affecting fruits and fruit trees.
III. Fungi affecting forest trees.

To the farmer in Iowa the diseases under the first head are of the greatest importance since the wealth of the State depends largely upon successful grain and forage crops.

I.—FORAGE CROPS AND CEREALS.

Diseases of wheat.—Aside from the usually common grain rusts (*Puccinia graminis*, and *P. rubigo-vera*) a serious disease of the wheat has appeared in the so-called "blight," or "scab," as the disease is called in different parts of the country. This disease causes the upper part of the

* *Glocosporium nervisequum*, (Fckl.) Sacc.

head to dry up and ripen prematurely. Although I have not made a thorough study of the disease it seems to be due to a fungus described by Worthington G. Smith* as *Fusisporium culmorum*. The genus *Fusisporium* is placed by Saccardo with *Fusarium*. In all probability Smith's species is one of the others affecting grains, but I have not compared them. The mycelium of the fungus is white or yellowish and permeates the kernel and flower. According to Smith the spikelets are glued together by a gelatinous substance produced by the threads and this causes their death. The hyphæ when placed in a nutrient solution produce an abundance of fusiform septate spores. It should be remembered that the genus *Fusarium* contains many representatives which are entirely saprophytic. Thus *Fusarium solani*, which is destructive to tomatoes, is not able as Prof. Galloway† has shown, to cause rot unless the tissues are somewhat disorganized. *Cladosporium herbarum* is not an uncommon fungus on "blighted wheat heads," and Frank‡ has shown that it is parasitic on the heads and leaves of various grasses. This disease seems to have been known for a long time in Iowa. Prof. Bessey so stated at the Indianapolis meeting of the Society for the Promotion of Agricultural Science; and it is also found in many parts of the United States, as Prof. Galloway stated at the same meeting. Dr. Weed has found it very destructive in parts of Ohio. Some varieties are more subject to the disease than others. Thus winter wheat was not subject to it nearly as much as some of the most highly prized of the hard wheats like the Saskatchewan.

Diseases of Barley.—Barley on the college farm at Ames this year, aside from the "rusts" and "smuts," has been subject to two diseases. One, *Scolecotrichum graminis*, Fuckl.,§ which has long been known as a serious pest to orchard, timothy, and other grasses.¶ The diseased leaves are marked with brown, or purplish brown, spots, which appear on the leaves transversely. The hyphæ, which are sometimes septate, make their way through the stomata and bear the small brownish spores at the end, or sometimes laterally. The fungus occurred on all of the varieties.

The other fungus is *Helminthosporium graminum*, Rabh. This appears earlier and is more destructive. Mr. Ellis, to whom specimens were submitted, writes that the fungus is, without doubt, Rabenhorst's *Helminthosporium graminum*, and this is the same as *H. inconspicuum*.

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* Diseases of Field and Garden Crops, p. 258.

† Report U. S. Dept. Agriculture, 1888, p. 339.

‡ Krankheiten der Pflanzen, p. 580.

§ Trelease, Dept. of Agrl. Report 1886, p. 129. Plate VII. Ellis, N. Am. Fungi. No. 1988 *a* and *b*.

‖ Bidrag till Kannedomen om vara odlade vaxters sjkdomar. pp. 185, pl. 9. Sorauer Just Bot. Jahresb. 1885 p. 502.

¶ Saccardo Sylloge fungorum, Vol. IV. p. 348.

C. & E.* and Passerini's *H. turcicum*.† The specimens in Ellis's North American Fungi were found on dead leaves of *Zea Mays*. Passerini's specimens were also found on the species, and he attributed it to the fungus he has described. Briosi and Cavara‡ have described, figured, and distributed the same fungus in their collection of parasitic fungi. In their spores these species seem to agree well enough with Rabenhorst's *H. graminum*, which was found by Caspary§ on barley. Frank considers it to be only a well developed *Cladosporium*. In 1885 Eriksson¶ found a disease on barley, near Upsala and Stockholm, which he considered identical with that found by Caspary on barley in Germany. The Iowa barley disease agrees with Eriksson's, but differs from the corn disease found by Passerini. According to this observer the leaves of corn affected by the fungus are at first yellow, then become more or less discolored, and finally wilt.

The spots in the specimens distributed by Briosi and Cavara on corn are sharply limited and extend across the veins. This disease manifests itself long before barley has "headed out." In this barley disease the spots extend from the base to the very tip of the leaf in parallel rows. The diseased leaves form quite a contrast to those of the adjoining healthy plants, as they are variegated pale yellow and green. All the stalks of a stool are affected. The plants die prematurely, and soon after death the leaves become torn into shreds. An examination of the affected parts when the variegated linear stripes appear shows a colorless mycelium permeating the tissues of the leaf. Later a number of erect septate hyphæ appear through the stomata or they break through the epidermis, bearing large three to six celled spores at the end. Occasionally one finds these hyphæ branched. The mass of brown hyphæ and spores along the veins can be easily seen with the naked eye. The spores germinate readily, often a number of germinating tubes coming from a single spore. I have also found the *Helminthosporium* where *Scolecotrichum*, and *Cladosporium graminum* had appeared, but not in such abundance.

The usual amount of smut has occurred during the past summer. *Ustilago segetum* of oats, barley, and wheat and *U. Maydis* of corn have done an unusual amount of damage. Grasses have also been affected by several kinds of smut, some of which are quite destructive.

Timothy Smut. (*Tilletia striæformis* (Westd.) Magnus).—Not only did

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* Ellis N. Am. Fungi No. 45. Grevillea Vol. VI, p. 88.

† La nebbia del granturco. pp. 3. Parmia Schroter Just. Bot. Jahresb. 1878. p. 184.

‡ Fungi Parassiti delle piante cultivate od utili essicati delineati e descritti. Fasc. III and IV, No. 81.

§ Herbarium Mycologicum No. 332.

‖ Krankheiten der pflanzen, p. 582.

¶ Ueber eine Blattflecken Krankheit der Gerste aus den Berichten der Botaniska Sällskapet i Stockholm. Bot. Centralbl. Vol. XXIX, p. 89. Sorauer Just Bot. Jahresb., 1885, p. 515. Distributed in Fungi Scand. No. 187.

this fungus occur on timothy growing on the campus, but quite seriously in the field as well. It is known to occur on many grasses in Europe* like *Alopecurus*, *Briza*, *Poa*, *Anthoxanthum*, *Milium*, *Holcus*, *Arena*, etc. In this country it is known to occur on *Agropyrum repens*, *Elymus Canadensis* var. *glaucifolius*.† I think it does not generally occur here on blue grass, but I have found it on that host in Cambridge, Mass. Last summer it was also found on the same host at Ames, where it was growing among timothy, forming the same lead-colored patches it does on that grass. I did not, however, observe that the leaves were afterwards torn into shreds, as it was cut soon after the fungus appeared. Very likely it does so, as it seems to be common when fungi attack grasses, especially along the veins of the leaf.

Brome Smut, (*Ustilago bromivora*, Fisch. de Waldh. var. *macrospora*, Farlow.) *Tall Meadow Oat Smut*, (*Cintractia avenæ*, Ellis and Tracy).—Early in June Mr. F. A. Sirrine called my attention to several smuts occurring on some of the cultivated grasses in the plats of the experiment station. The first (*Ustilago bromivora*, Fisch. de Waldheim) is apparently the variety *macrospora*‡ of Farlow. It occurs abundantly on one of the best of our native species of *Bromus* (*B. breviaristatus*) and it has been reported on *B. ciliatus*, by Dr. Halsted. It affects the inflorescence so as to completely destroy it. This smut will probably not occasion much loss, as it attacks the inflorescence and the grass can be cut before it appears, but it must greatly injure its vitality.

The second destructive smut was found on *Arena elatior*. This was more common than the Brome smut and seems to be the same as has been found by Prof. Tracy in Mississippi on the same host, and called *Cintractia avenæ*, Ellis and Tracy.§ It transforms the ovary into a compact mass, which is made up of small brownish spores.

This year *Ustilago panici-miliacei* (Pers.) Wint., was very common on *Panicum capillare* and *P. sanguinale*, completely destroying a large number of the plants. Last year it was noticed abundantly only on the latter host, none being found on *Panicum capillare*. It was observed on the latter by Prof. Arthur‖ some years ago about Ames. This fungus does not seem to differ from *U. syntherismæ* occurring on the sandbur (*Cenchrus tribuloides*), and unless experiments have been made to decide whether Panicum smut can be transferred to the sandbur and *vice*

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*J. B. De Toni in Saccardo Sylloge Fungorum, Vol. II, p. 484. Winter Die Pilze, Vol. I, p. 108. The following hosts are given by Winter: *Agrostis stolonifera, A. vulgaris, Calamagrostis Halleriana, Milium effusum, Holcus lanatus, Arena elatior, Briza media, Poa pratensis, Dactylis glomerata, Festuca ovina, F. elatior, Bromus inermis, Lolium perenne.*

†Trelease, Smut of Timothy. Dept. of Agrl. Report. Ellis North American Fungi, No. 1498.

‡Bull. Iowa Agrl. College, 1886, p. 59. Saccardo Sylloge fungorum, Vol. VII, p. 461. Winter l. c., Vol. 1, p. 77.

§Journal of Mycology, Vol. VI, p. 77.

‖Bull. Iowa Agrl. College, 1884, p. 172.

versa, they should be placed together. I mention these cases to show how destructive some fungus diseases are some years and they do not appear at others.

Clover Rust, (*Uromyces trifolii*, Alb. & Schw.) Wint., is referred to by Prof. Dudley in a recent bulletin as occurring on red clover in New York in a very destructive way. I think it has not been previously reported on that host in this country, though occurring abundantly on it in Europe, according to Frank, Kraft, and others. Clover rust has long been known to occur on white clover in this country, and is at times quite destructive. In August my attention was called to the rust occurring on the campus close to the botanical laboratory. The plants affected were somewhat trodden, but nearly every stalk had its leaves badly diseased. The affected plants soon withered. After the first discovery the rust was soon noticed some 30 feet away, attacking the leaves and stems. It was quite general, as students brought specimens in from the field and various places on the college farm and campus. During the months of August, September, and early October, only uredospores were found, but later teleutospores were produced very abundantly. The stems were marked with longitudinal brownish sori so thick that in touching the plant the hands were colored brown. The teleutospores made their appearance first on the stems, and later they appeared on the petioles and leaves.

Uromyces trifolii also occurs on crimson clover (*Trifolium incarnatum*).* Some years ago it was very bad in an experimental plat at Madison, Wis. The fungus is more destructive to this plant than to red clover. It has also been found on the same host at Ames by Mr. Sirrine. In this country the fungus has been principally reported as destructive on white clover, and commonly all three stages occur on it. Miss Howell has recently shown that the fungus on red and on white clover is identical, and that the uredo and teleutospores can be produced from the æcidium which appears early in the summer.

II.—FRUITS AND FRUIT TREES.

Plum Scab or Black Spot.—For two seasons I have watched with some interest a fungus which causes the plums of some of the cultivated varieties of *Prunus Americana*, especially the Miner, to become spotted and more or less scabby. So far as I know this has not been recorded before, though Professor Osborn informs me he has observed a similar appearance for some years. It is not improbable that the disease may be quite common in the Northwest. The cause of the spotting is a parasitic fungus which seems to be closely related to the fungus causing the black spot disease of peaches (*Cladosporium carpophilum.*) The last species was described by Felix Von Thümen in 1887† and he records

* Trelease Parasitic Fungi of Wisconsin, No. 152, p. 21.
† Symb. Mycol., p. 107.

it as very troublesome in that year and the year before. Recently Prof Arthur* has recorded it as very widespread in Indiana, and Dr. Erwin F. Smith† as quite destructive in Delaware, Michigan, etc. Professor Galloway, who has kindly allowed me the use of his unpublished notes, records it as very destructive in many parts of the United States. The principal loss results from unattractive peaches and premature decay, due to *Monilia fructigena* and other saprophytic fungi. In Texas I have seen many peaches affected by it, especially the late varieties. The plum fungus differs in some respect from the peach, but this may not be sufficient to make a new species.

So far I have only found the fungus on the fruit, but the peach fungus is recorded by Prof. Galloway on the leaves as well. When plums begin to ripen, or are just turning in color, small round patches not larger than a pin head make their appearance. They are pale greenish or grayish in color. These spots increase in size till in some cases they are half an inch across. They are usually round, with a somewhat paler border. In older specimens the patches are frequently confluent and of darker brown color. In very old specimens, especially in those where the fruit has undergone decomposition, the patches become black and uneven.

An examination of the small grayish spots shows a nearly colorless mycelium creeping over the surface. In the darker portions of the large patches are septate hyphæ. In some cases these can be seen to come through cracks in the cuticle. They are irregular in outline and frequently bent. As the material becomes older a dense stroma of short brownish hyphæ appears. It lies between the cuticle and the cellulose layers of the cell wall. In cross section the hyphæ are more or less angular in appearance, but when free they are rounded. This stroma, especially under favorable conditions, keeps on producing the erect septate hyphæ, which bear the slightly colored spores at the end. They are oval in form, pointed at the end, and usually two celled. The spores germinate readily when kept in a moist chamber, producing a colorless tube.

The fungus itself does not impair the qualities of the fruit, as the injury is little beyond where the spot appears, affecting only three or four layers of cells underlying the spot. Outside of the spot the tissues have their normal appearance. The cell contents of the affected parts are brown and dead. This death of cells causes a loss of water, and, as a result, small cracks appear in the cuticle through which the hyphæ can readily enter the plant. But this entrance, so far as I have observed, is only superficial, never in the epidermal layer, nor even beyond the cellulose layer of the cell wall of the epidermal cell. It is not uncommon to find large cracks or rifts through the outer patches. Plums affected by this fungus invariably show *Monilia fructigena*, putrefactive

* Bull. Agrl. Experiment Station, Indiana, No. 9, 1889.
† Jour. Mycology, Vol. v. p. 32.

bacteria, and less commonly *Rhizopus nigricans*, which cause a rapid decay of the fruit. A number of affected plums were placed in a moist chamber and these were soon covered with a vigorous growth of *Monilia*, its mycelium spreading in all directions. Its growth subsided in a few weeks, when mycelial masses were formed.

The plum fungus seems to differ chiefly from the one occurring on peaches in the shorter hyphæ and somewhat smaller spores. Those on the peach are occasionally borne laterally. The more vigorous hyphæ of the peach may be due to physiological causes. Mr. Ellis, to whom specimens were submitted, thinks it is a distinct species.

Anthracnose of currants, (*Glœosporium ribis* (Lib.) Mont. and Desm.).—Attention has been directed to this disease by several investigators.*

It is very destructive, causing the leaves to become spotted on the upper surface, and to fall long before the proper time. Sometimes the leaves drop early in August. The spores come from small dark-brown specks. When ripe the epidermis breaks, allowing the spores to ooze out in tendrils. It is most commonly found on *Ribes rubrum* at Ames.

Two other destructive diseases have also appeared on currants. One is caused by a species of *Septoria*. The spots are at first brown, later becoming pale on the upper and brown on the under surface. Each spot has a number of small conceptacles, which contain the slender spores. Another disease found on *Ribes rubrum* causes a similar spotting but does not contain conceptacles, the hyphæ breaking through the epidermis and bearing the *Cercospora* spores. Both of these fungi cause the leaves to drop prematurely. The Septoria disease is the more destructive.

Cylindrosporium padi, Karsten.—It has become practically impossible to grow good cherry seedlings on account of this fungus. Leaves begin to fall early in June, and where cherries are budded the young growth continually produces spores throughout the season.

The cluster cup fungus of gooseberries (*Æcidium grossulariæ* DC.) has been very destructive to cultivated gooseberries and a common cultivated shrub, *Ribes alpinum*. It not only affects the leaves but causes the fruit to become greatly distorted and worthless.

Black knot (*Plowrightia morbosa*), although occurring abundantly on a large number of hosts of the genus *Prunus*, is especially destructive to wild plums and cherries in this State (*Prunus Americana*, *P. serotina*, *P. Virginiana*), frequently causing the death of the plant in a few years. It is not uncommon to find it on *Prunus domestica*, and within the last year it has been found on one of the Chinese apricots (*Prunus Armeniaca*) on the college grounds. The tree upon which the fungus was found has been subject to much pruning, and possibly infection has been brought about in this way. It is not improbable that

*Dudley, Agric. Exper. Sta., Cornell Univ., Ithaca, Bull. 15, p. 196; Peck, 38th and 43d Report N. Y. State Mus. Nat. Hist., p. 98, 6; Seymour, American Garden, Vol. XI.

the pruning has lowered its vitality and rendered it liable to the disease.

Vibrissea hypogæa has also been found at Ames on an old dead grape root.

White rust of beets.—Late in October, when the beets were being harvested, one of the students, Mr. W. Zmunt, brought a leaf of the common beet, which showed several white pustules which proved to be a *Cystopus*. A careful search through other herbaria has shown more specimens. I have not seen the oöspores, so I can not say to which species it belongs, but the conidia resemble those of *Cystopus bliti* (Biv.) de Bary. This has not been recorded as occurring on any of the Chenopodiaceæ in the United States. Frank,* Sorauer,† Berlese, and De Toni‡ record it as occurring on *Chenopodium*, a genus closely related to *Beta*. Here again we are confronted with the question why this *Cystopus* should affect the beet in Iowa and apparently has not been found on this host in other parts of the world. It certainly seems that if the fungus had occurred commonly it would have been observed before.

III.—FOREST TREES.

Thus far I have not observed *Glœosporium nervisequum* on sycamore trees in the vicinity of Ames, but a fungus giving the leaves of *Æsculus glabra* a similar scorched appearance was found early in August. It is due to the parasitic fungus *Phyllosticta sphæropsoidea*, E. and E. By the middle of September many of the leaves were dry and had fallen from the trees.

Cedar-apple fungus.—So far as I know the only recorded species for this locality is *Gymnosporangium macropus*, but last spring a second species, *G. globosum*, was found infesting one of the cedars. *G. macropus* is the common species in Illinois, Wisconsin, and Iowa, and I think is the common "cedar apple" in most parts of the United States. Dr. Halsted§ concluded that we have only one species in this locality. I found only a single specimen of the other after a diligent search. It might in this connection be interesting to state that some of the wild crab apples close to *Juniperus Virginiana* have been so severely attacked by *Rœstelia pyrata* that not only was every leaf affected but the fruit and young branches as well. The young branches usually died, so that the trees are in a bad condition. It was also noticed that before *Gymnosporangium macropus* appeared the leaves coming from the small lateral branches were yellow, as if they had been infested by the fungus. Other duties have prevented my studying these early yellow

* Krankheiten der Pflanzen, p. 419.

† Pflanzenkrankheiten, Vol. II, p. 175.

‡ Saccardo Sylloge fungorum, Vol. VII, p. 236.

§ Halsted, Bull. Iowa Agric. College, Botanical Dept., 1886, p. 63. Report U. S. Dept. Agriculture, 1888, p. 370.

leaves carefully. Dr. Farlow* refers to *Roestelia aurantiaca* as possibly being perennial.

Marsonia juglandis (Lib.) has been quite destructive to *Juglans cinerea* and *J. nigra*, causing brown spots to appear on the leaves. Trees thus affected lose their foliagepre maturely. *Marsonia Martinii* Sacc. and Ell., commonly occurred on *Quercus alba* and *Q. rubra*, causing pale colored spots with two-celled spores. *Phyllactinia suffulta* occurred destructively on *Fraxinus* at Ames the past summer.

REMARKS ON THE FUNGUS OF A POTATO SCAB.

(*Spongospora solani* Brunch.)

By Prof. G. de Lagerheim.

In purchasing some potatoes at a market in Quito for use in bacterial cultures, I noticed while cleaning them that they were affected with black warts. An incision into these warts convinced me that they were caused by the fungus *Spongospora solani*, described by Brunchorst† several years ago. This disease is said not to occur in North America,‡ as the disease known as "scab" is there produced by other fungi. Since South America is the home of the potato, it seemed to me of interest to study this disease here. The disease is generally known in Quito, and manifests itself on potatoes from various localities. It is called "Cara,"§ and is supposed to be occasioned by the gnawing of worms.

The microscopic appearance and the behavior of the warts coincide fully with the description and illustration given by Brunchorst (loc. cit., p. 219, Plate I, Fig. 2). While the microscopic illustrations of Brunchorst were quite accurately drawn, they were, nevertheless, altogether erroneously interpreted. The wart-forming tissue, which he considers as a part of the potato altered by the disease, is the pseudo-parenchyma of fungus hyphæ, in which the characteristic spore balls arise. The fungus is, therefore, not a Myxomycete, and has no relation to Plasmodiophora. In cross sections of the warts hyphæ are often seen growing out of the pseudo-parenchyma, their membranes being precisely of the same color as the cells of the pseudo-parenchyma. The membranes of the hyphæ are of a more or less purple-brown color. In a wart that does not yet contain spores the hyphæ are filled with a colorless protoplasmic substance, which is very often full of vacuoles. It is perhaps

* Farlow: The Gymnosporangia or Cedar Apples of the United States. Memoirs Boston Soc. Nat. Hist.

† Regarding a very widespread disease of the tubers (Bergens Museum, Aarsberetning, 1886) Bergen, 1887.

‡ According to Thaxter. Report of the Mycologist, p. 6 (Fourteenth Annual Report of the Connecticut Agricultural Experiment Station, 1890), New Haven, Connecticut.

§ A word from the Quichua language, which means scab in English, or *sarna* in Spanish.

this vacuolated protoplasm which Brunchorst (loc. cit., Plate I, Fig. 6) mistook for the plasmodia of his *Spongospora*. In the warts containing mature spore balls the hyphæ are usually empty. The structure of the spore balls was correctly understood and drawn by Brunchorst (loc. cit., p. 221, Plate I, Figs. 4, 5), but they are not detached, being fastened to the surrounding hyphæ of the pseudo-parenchyma. In thin cross sections one can easily see that this is so, and that very often, if not always, branches of the hyphæ penetrate the interstices of the spore ball, fill them up, and are firmly united to the individual spores. According to this the development of the spore balls is quite different from the one stated by Brunchorst (loc. cit., p. 223). I did not meet with any early stages of the spore formation among my material. According to the structure of the mature spore balls it is presumable, however, that they arise in the following way: Neighboring hyphæ develop upon the pseudo-parenchyma, and divide up into small cells which cling firmly to, and partly surround, the sporogenus hyphæ. The outer membrane of the peripheral spores is not quite smooth, but seems granulose. The size of the individual spores agrees with the statement made by Brunchorst. I have been as unsuccessful as Brunchorst in making the spore balls germinate. Until we understand their manner of germination it would be premature to assign the fungus to any definite place in the system of classification. Probably the liberation and germination of the spores results through the decay of the surrounding pseudo-parenchyma. Brunchorst mentions that the crusts are frequently eaten by insect larvæ, and this seems to be the case here also. It is probable that the spores pass through these insects without sustaining any injury, and are distributed in this manner. It might prove of interest to make experiments in this line.

In conclusion a few words may be said in regard to the correct name of the fungus. It seems to me that *Spongospora solani* Brunchorst is identical with a fungus long known and described by various authors. The name of this fungus is *Erysibe subterranea* Wallroth (Linnea, 1842, p. 332), which is said to have the following synonyms:

Protomyces tuberum-solani, Martius, Kartoffel Epid., 1842, p. 28, t. II, Figs. 9–13, t. III, Figs. 36–38.

Tubercinia scabies, Berkeley, Journ. Roy. Hort. Soc., 1846, vol. I, p. 33, Figs. 30, 31.

Sorosporium scabies, Fischer von Waldheim Aper. Syst. Ustil., 1877, p. 33.

Unfortunately the publications of Wallroth, Martius, and Berkeley are not accessible to me, which renders it impossible for me to decide this question. If my supposition be correct, the fungus should be called *Spongospora subterranea* (Wallr.).

Microbiological Laboratory at Quito, *June 24, 1891.*

DESCRIPTION OF TWO NEW SPECIES OF PERONOSPORA.

By M. B. Waite.

Peronospora celtidis.

(Plate XVII, Figs. 1–16.)

Spots definite, angular, minute, about 1^{mm} or less in diameter, limited by the veinlets; by confluence forming irregular patches or covering the greater part of the leaf; dark purple above, and when close together surrounded by an indistinct yellow border; on the under side at first dark green in color, with a water-soaked appearance, becoming ashy gray as the conidiophores are thrown up, then brownish, the confluent patches soon becoming brown.

Mycelial hyphæ small, delicate, much branched, from 3 to 7½μ in diameter, averaging about 6μ, with very thin and hyaline cell walls. Haustoria not seen.

Conidiophores slender, four to five times branched and bearing from 14 to 28 conidia, branching in the so-called dichotomous manner, but with the first branch extending outward at nearly a right angle. Branches and tips nearly straight, tips gradually tapering to a blunt point. Total length of the conidiophores 200 to 320μ. Length of the stem to the first branch nearly equal to the length of the head from the first branch to the tip.

Conidia elliptical, nearly twice as long as broad, 14 by 26μ to 20 by 38μ, averaging about 16 by 31μ, provided with a blunt apiculus and a swelling at the base which closely resembles that at the apex, making the two ends appear alike, dark, smoky colored; germinating by zoöspores, eight or nine in number, which break through the apical papillus. In living specimens viewed with a low power of the microscope as an opaque object the conidia appear black, and the conidiophores are hygroscopic.

Oospores produced abundantly in the leaf parenchyma, to which the whole fungus seems to be limited; subglobose, light brown in color, 28 by 36μ to 30 by 44μ; endospore rather thin; exospore smooth, quite variable in thickness, causing the margin of the oöspore to appear undulate in cross section. Walls of the oögonium thin.

On *Celtis occidentalis*, L. Washington, D. C., October 7, 1891, Herb. M. B. Waite, No. 556; October 9, 1891, Herb. M. B. W., No. 557. Still Pond, Md., October 10, 1891, Herb. W. T. Swingle, Nos. 4026, 4027.

Observations:—This species is an exceptional form in many respects. It is the only species in the family so far found growing on a tree, although *Phytophthora omnivora* grows on seedlings of *Fagus* and other trees, and *Plasmopara viburni*, Peck, on *Viburnum; P. viticola*, on *Vitis; P. ribicola* on *Ribes*, *Peronospora sparsa* on *Rosa* and *P. rubi* on *Rubus* all grow on woody plants. The spots formed on the leaves are usually small and

would at first glance scarcely be thought to be the work of a Peronospora. The leaves of the host plant are harsh and firm in texture. Whether from adaptation to this peculiar host or from other causes this species seems to have developed on different lines from most Peronosporaceæ. It does not fit well into the present scheme of classification. The germination by zoöspores would suggest Plasmopara, but the long, dark-colored conidia are much unlike the typical conidia of that genus, which are small, orbicular, and hyaline. The conidia of this species are also remarkable for the papillus at the base. The conidiophores are similar to those of Peronospora, but the nearly straight branches and the tendency of the first branch to come out at nearly a right angle gives at least a suggestion of Plasmopara. It should be remarked that the so-called pinnate conidiophores of Plasmopara are not pinnate. The lateral branches are rather short and are arranged along a lengthened axis after the manner of the two-fifths phyllotaxy in phenerogams. In the dichotomous forms, as in Peronospora, the branches are arranged in the same way except that the lowest branch is relatively long and extends upward rather than straight out, but there is rarely any difficulty in deciding which is the main stem. They are not, then, truly dichotomous.

The conidiophores of *P. celtidis*, while of the type *Peronospora*, may be regarded as a step toward *Plasmopara*. So far as known to me no one has studied the exact arrangement of the branches of the conidiophores of any species of this order. Outline drawings are scarcely satisfactory representations of these objects, because they do not clearly indicate whether a given branch extends up or down from the plane of the drawing. The figures of the conidiophores given on Plate XVII are open to this objection. It is not easy to determine how each branch extends, much less to represent it accurately in a drawing.

The mycelium of this species looks quite unlike the typical mycelium of Peronospora. It is much more delicate and somewhat resembles that of the Uredineæ. The oöspore is apparently identical with that of the section *Effusæ*. The oöspores of the two species represented on the plate are strikingly similar except in size. But with all the characters taken into account one would scarcely wish to place *P. celtidis* in the section *Effusæ*. Mr. W. T. Swingle has pointed out to me that *Peronospora cubensis*, B. and C., resembles *P. celtidis* quite closely, and is its nearest ally, and that these two species form a group by themselves, differing considerably from either *Peronospora* or *Plasmopara*. Both have long, very dark conidia, pointed at each end and germinating by zoöspores, with conidiophores of the so-called dichotomous type, and strongly hygroscopic. For the present the form on Celtis is thought to be best placed in the genus *Peronospora*.

Peronospora hydrophylli.

(Plate XVII, Figs. 17-24.)

Spots yellowish on both sides of the leaf, but more visible from above, 2 to 4mm broad by 10 to 25mm long, with rather indistinct margins, limited laterally by the veins, or by confluence covering the greater part of the leaf, becoming brown with age or causing the whole leaf to shrivel up. Under surface of the spots sparsely frosted by the conidiophores.

Mycelial hyphæ occasionally branching, quite irregular, narrowed down at frequent intervals to half the average diameter and covered with protuberances, some of which are sufficiently extended to form branches; diameter varying from 6 to 7μ in the constricted portions to 15 or 16μ, or even more, in the swollen parts, averaging 10 to 12μ.

Haustoria small, 15 to 24μ long, consisting of a short, broadly clavate branch with three to five finger-like small branches arranged in a whorl around its apex.

Conidiophores rather large, dichotomously many times branched, the branches bent into reversed curves and often twisted around each other; tips slender, tapering to a blunt point, curved or often with a reversed curve, numbering sixteen in a small specimen to fifty on an average, or to seventy-five on a very large one. Total length of the conidiophore varying from 200 to 450μ, length of the stem to the first branch varying from one-half to four-sevenths the total length. The first branch is relatively large, usually from two-thirds to three-fourths of the length of the whole head, and contains about that proportion of the tips, often nearly equaling the rest of the head.

Conidia ovate, without apical papillæ or marks to indicate the point of attachment; smoky colored, measuring 19 by 28μ to 25 by 35μ, averaging about 21 by 30μ; germinating by means of a lateral tube which is often curved in a loose spiral and usually at one or two points swollen abruptly to twice the normal size, which is gradually resumed again.

Oöspores produced in the leaf parenchyma, subglobose, 39 to 45μ in diameter, light brownish in color; endospore rather thick; epispore thin in places, causing the margin of the spore to become undulate in section. Walls of the oögonium thin.

On *Hydrophyllum Virginicum*, L. Oregon, Ill., June 1, 1888. Herb. M. B. Waite, No. 558. Near Washington, D. C., May 5, 1889, No. 559, a single infected plant. Iowa City, Iowa, spring, 1888. A. S. Hitchcock.*

Observations.—It will be seen from the description and drawings that this species is a typical *Peronospora* of the section *Effusæ*. It presents no difficulties in classification unless it be in the fact that the species in the section *Effusæ* are not very clearly defined, and botanists are obliged to depend mainly on the host plants for the determination of the species. The germination of the conidia was accomplished by

* These specimens are mentioned, but not described, by McBride and Hitchcock, in Bull. No. 1, from the Laboratories of Nat. Hist. of the State Univ. of Iowa, p. 51.

placing them in water on a glass slide, under a bell jar. The conidia used for the purpose were taken from fresh leaves which had been gathered in the tin collecting box and had remained there several hours. They were placed in water during the day, and on the following morning they had thrown out their germ tubes. These show one or more peculiar swellings or bulb-like expansions. This is not rare in the Peronosporaceæ, but has been observed in a number of species. De Bary figures* the germinating conidia of *P. effusa* and several other species showing this character.

There is often more than one conidiophore extending from a stoma. In some cases as many as five were seen. (Plate XVII, Fig. 19.) The manner in which the conidia originate from the mycelium is the same as in *Bremia lactucæ* as figured by Cornu.† A mycelial thread running near a stoma sends out a branch which is contracted at the point of emission, but soon swells out so as to nearly equal the parent branch. As it nears the opening of the stoma it narrows down to a small filament which passes through the opening between the guard cells and then swells out into the bulb-like base of the conidiophore.

Type specimens of both these species have been deposited in the herbarium of the Division of Vegetable Pathology, U. S. Department of Agriculture, and have been sent to the following herbaria: Philadelphia Academy of Science; Columbia College, New York; Harvard University, Cambridge, Mass.; Royal Herbarium, Kew, England; Museum of Natural History, Paris; Royal Botanic Garden, Berlin; Royal Botanic Garden, Rome; Museum of the Royal Botanic Garden, St. Petersburg, and to several individuals.

EXPLANATION OF PLATE XVII.

Figs. 1–16, *Peronospora celtidis*, n. sp.

Figs. 1, 2. Leaves of *Celtis occidentalis* showing spots caused by the Peronospora.
3. Typical conidiophore × 224. The branches do not all lie in one plane, as the figure might lead one to think, but are arranged around the stem like the branches of a tree. The lowest branch extends to the right and upward; the second branch extends to the left and also slightly upward.
4. Conidiophore below the average size, × 224.
5. Tips of the conidiophore more enlarged, × 640.
6. Young conidiophore with conidia attached, × 224.
7. Conidiophore nearly mature but with protoplasm still in the stem, × 224.
8. Conidium, with its contained zoöspores, just ready to burst.
9. Conidium discharging its zoöspores.

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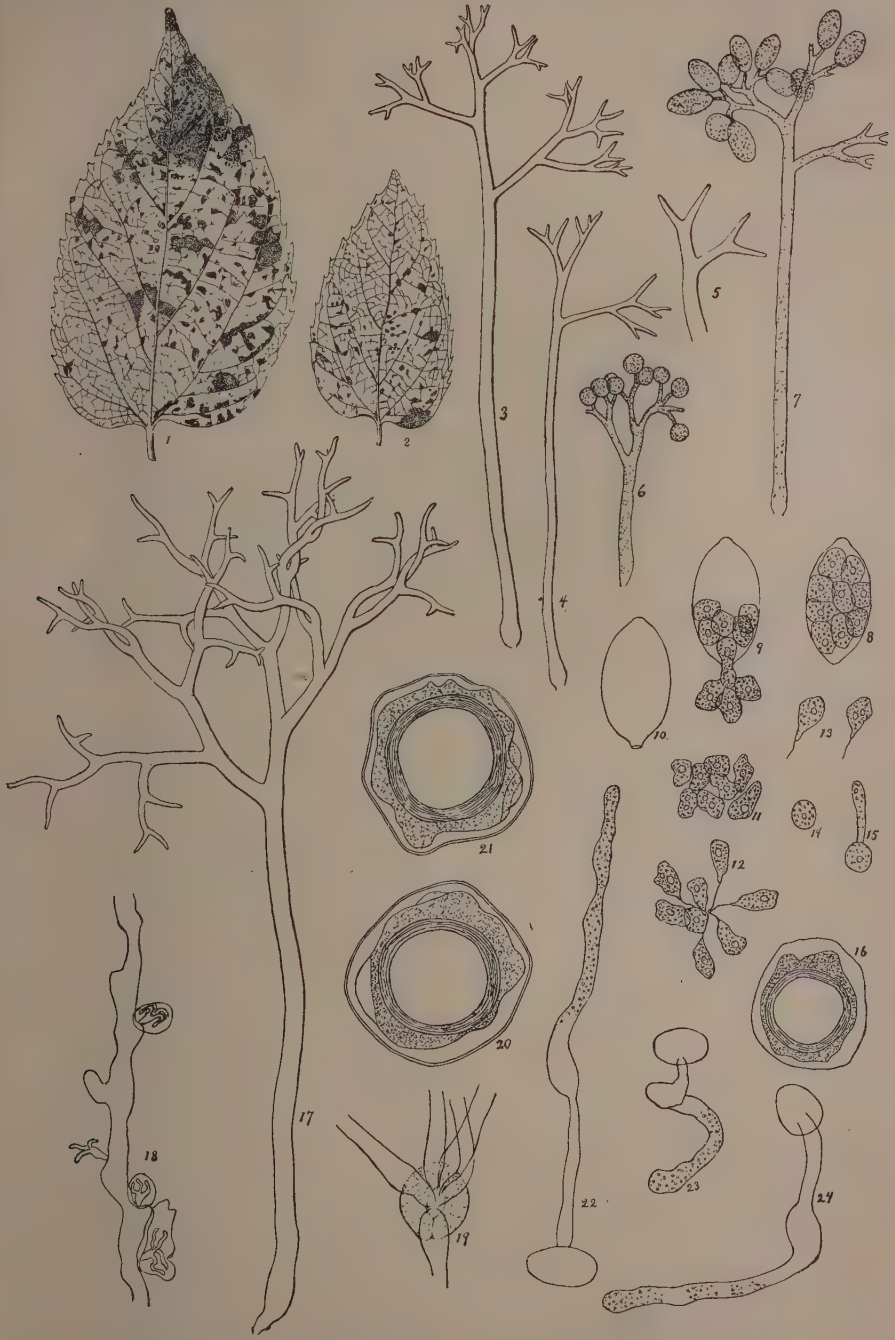
* Recherches sur le développment de quelques Champignons Parasites. Ann. Sci. Nat. Botanique, sér. 4e tome xx, Plate 8, Fig. 7.

† Institute de France. Académie des Sciences. Observations sur le Phylloxera et sur les Parasitaires de la Vigne, etc. Études sur les Péronosporées. I. Le Meunier, Maladie des Laitues, 1881.



WAITE ON NEW SPECIES OF PERONOSPORA.

Fig. 10. Empty conidium.
11. Mass of zoöspores just escaped and still fastened together.
12. The same breaking apart.
13. Zoöspore swimming free. One cilia represented. Two or three doubtfully observed.
14. Zoöspore rounded up and at rest.
15. Zoöspore germinating.
16. Oöspore in section, × 640.

Figs. 17–24, *Peronospora hydrophylli*, n. sp.

17. Conidiophore, average size, × 224.
18. Mycelium, with haustoria and cells of the host penetrated by them, × 224.
19. Stomate, with five conidiophores extending from it, × 224.
20, 21. Oöspores in section, × 640.
22–24. Germinating conidia.

SOME PERONOSPORACEÆ IN THE HERBARIUM OF THE DIVISION OF VEGETABLE PATHOLOGY.

By W. T. Swingle.

Finding a number of interesting species of Peronosporaceæ in the herbarium of the Division of Vegetable Pathology, I have decided to report on all specimens there represented that have not been mentioned previously. I have included a number of interesting forms collected during the past year, but have excluded all specimens in exsiccati as they are already known to most students of the group. I have included every collection, even of the most common species, because the record of date and locality may, even in such cases, prove of value in the future. Every specimen has been examined for oöspores and they have been reported whenever found. Nothing is mentioned in the paper that is not represented by a specimen in the herbarium.

ALBUGO (Persoon, §).

S. F. Gray. A natural arrangement of British plants, vol. 1, 1821 p. 540, No. v, p. 155.
1801. *Uredo* § *Albugo*, Persoon. Synopsis method. fungorum, p. 223.
1847. *Cystopus*, J. H. Léveillé, Sur la disposition méthodique des Urédinées. <Ann. des Sci. Nat., 3e sér., Botanique, tome 8, Paris, 1847, p. 371.

There seems to be no doubt that the generic name *Cystopus* must be abandoned in favor of *Albugo*, which has twenty-six years priority. There can be no question as to the identity of the two genera. Gray includes *Albugo* in the subfamily *Cœomideæ* which he describes thus:

Sporidia dust-like, free, heaped, sessile or pedicelled, one or many celled, growing at first under the epidermis of living plants, then bursting through it, naked or covered with a false peridium or thecæ formed of the epidermis of the plant on which it grows.*

* Loc. cit., p. 532.

Rœstelia, *Æcidium*, *Ustilago*, *Uredo*, and *Albugo* are included in this subfamily. The genus is described as follows:

v. 155. *Albugo*, Persoon.—Sporidia globular, sessile, one-celled, inclosed in the bullated epidermis of live plants.—White.*

The species *Albugo cruciferarum*, Gray (*Albugo candida* (Pers.) O. Kuntze), *Albugo tragopogi* (Pers.) Gray, and *Albugo petroselini* (DC.) Gray, are included under *Albugo*. Thus not only is the genus unmistakably characterized in the description, but all the species included, excepting possibly *A. petroseleni*, are still retained in the genus. Otto Kuntze in his "Revisio generum plantarum," issued in 1891, has restored *Albugo*. I may say that I had already decided that the change was necessary. It is a fortunate accident that the older name proves to be one so well adapted. It was long used as a subgeneric name for white rusts. Berkeley, writing in 1848, says:

Dr. Léveillé has described the genus under the name of *Cystopus* with very correct characters. It is to be wished, however, that he had adopted Schweinitz and Rabenhorst's sectional name of *Albugo* (Rab. Crypt. Fl., vol. 1, p. 13), which is far more expressive; and as a general principle sectional names ought certainly to be adopted when the sections are raised to the rank of genera.†

1. Albugo candidus (Persoon) O. Kuntze. Revisio generum plantarum, Pars II, 1891, p. 658, footnote 1.

1791. *Æcidium candida*, Persoon. <Gmelin, Caroli a Linné Systema nat., ed. 13, tome 2, pars 2, 1791, p. 1473.

1847. *Cystopus candidus* (Persoon), Lévéille. Sur la dispos. méthod. des Urédinées. <Ann. Sci. Nat., 3e sér., t. 8, 1847, p. 371.

Conidia on leaves, stems, and inflorescences, oöspores in stems and inflorescences of Cruciferæ.

On *Cardamine ludoviciana*, Meyer. S. M. Tracy, March 21, 1888, Starkville, Oktibbeha County, Miss. Conidia only, on radical leaves.

On *Dentaria diphylla*, L. L. M. Underwood. May, 1889, Dryden, Tompkins County, N. Y. Conidia and immature oöspores on leaves.

On *Sisymbrium canescens*, Nutt. F. D. Kelsey, April, 1888, Billings. Yellowstone County, Mont. Conidia only, on cauline leaves. F. D. Kelsey, No. 15, June, 1888, Helena, Lewis and Clarke County, Mont. Conidia only, on cauline leaves.

On *Sisymbrium linifolium*, Nutt. F. W. Anderson, No. 9, May 17, 1887, Helena, Lewis and Clarke County, Mont. Conidia only, on stems and cauline leaves.

On *Brassica alba*, L. E. M. Fisher, No. 88, August, 1890, Urmeyville, Johnson County, Ind. Conidia only, on cauline leaves.

On *Brassica nigra*, Koch. T. A. Williams, No. 274a, June, 1890, Weeping Water, Cass County, Nebr. Conidia only, on leaves. E. M.

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*Loc. cit., p. 540.

† Berkeley, M. J. On the White Rust of Cabbages. <Jour. Hort. Soc., London, vol. 3, London, 1848, pp. 269–270 (p. 8 of reprint).

Fisher, No. 72, July 22, 1890, Urmeyville, Johnson County, Ind. Conidia only, on cauline leaves.

On *Nasturtium sessiliflorum*, Nutt. S. M. Tracy, July 11, 1887, Wadsworth, Washoe County, Nev. Conidia only, on leaves, stems, and capsules.

On *Nasturtium armoracia*, Fries. B. T. Galloway, May, 1887, Boone County, Mo. Conidia only, on stems, flowers, and on radical and cauline leaves.

On *Capsella Bursa-pastoris*, Moench. W. T. Swingle, No. 4000, May 2, 1891, Alexandria, Alexandria County, Va. Conidia only, on leaves, stems, and inflorescences; oöspores, immature in stems. W. T. Swingle, No. 4002, May 22, 1891, Norfolk, Norfolk County, Va. Conidia on capsules; oöspores mature, abundant, in stems and infloresences. B. T. Galloway, June 13, 1888, Washington, D. C. Conidia on leaves and stems; oöspores immature in stems. M. B. Waite, No. 333, November 17, 1888, Department Agriculture grounds, Washington, D. C. Conidia only, on radical leaves.

On *Lepidium Virginicum*, L. M. B. Waite, No. 259, May 13, 1888, Oregon, Ogle County, Ill. Conidia only, on cauline leaves.

On *Lepidium* (sp. ?) H. W. Ravenel, No. 291b, 1869, Houston, Harris County, Tex. Conidia only, on leaves. T. A. Williams, No. 274^{b}, June, 1890, Weeping Water, Cass County, Nebr. Conidia only, on radical leaves.

On *Lepidium campestre*, Br. W. T. Swingle, No. 4003, May 31, 1891; low ground by monument, Washington, D. C. Conidia and mature oöspores in stems.

On *Raphanus sativus*, L. E. M. Fisher, No. 83, July 25, 1890, Urmeyville, Johnson County, Ind. Conidia only, on both sides of radical leaves. E. M. Fisher, No. 83, August, 1890, Urmeyville, Johnson County, Ind. Conidia and oöspores in enormously distorted flowers.

2. **Albugo portulacæ** (De Candolle) O. Kuntze, loc. cit., 1891, pars. II, p. 568.

1815. *Uredo portulacæ*, De Candolle. <Lamarck et De Candolle, Fl. française, t. V ou vol. VI, p. 88, No. 637.

On leaves of Portulacaceæ.

On *Portulaca oleracea*, L. T. A. Williams, No. 255, June 18, 1890, Weeping Water, Cass County, Nebr. Conidia and mature oöspores in leaves. S. M. Tracy, July 10, 1888, Starkville, Oktibbeha County, Miss. Conidia and mature oöspore in leaves. M. B. Waite, No. 127, August 8, 1885, Oregon, Ogle County, Ill. Conidia only. E. M. Fisher, No. 163, August, 1890, Urmeyville, Johnson County, Ind. Conidia only. M. B. Waite, (Herb. Div. Veg. Path. No. 377), September 19, 1889, Champaign, Champaign County, Ill. Conidia and mature oöspores in leaves. G. W. Clinton, 18—, Buffalo, Erie County, N. Y. Conidia only.

3. Albugo tragopogonis (Persoon) S. F. Gray, Nat. Arrang. Brit. Plants, vol. 1, 1821, p. 540.

1801. *Uredo* (*Albugo*) *candidus* Pers. *β. Uredo Tragopogonis*, Persoon. Syn. meth. fung. 1, p. 223, No. 348.

1886. *Cystopus Tragopogonis* (Persoon) Schroeter. Die Pilze Schlesiens, Hälfte 1, p. 234.

On leaves of Compositæ.

On *Helianthus* (sp. ?). C. A. Hart, July 12, 1883, Quincy, Adams County, Ill. Conidia and mature oöspores in leaves. C. A. Hart, July 17, 188–, West Quincy, Adams County, Ill. Conidia and mature oöspores in leaves. I am inclined to think the host is *Iva ciliata*, but can not be certain. As far as I know *A. tragopogonis* is unknown on *Helianthus*, although it is abundant in some places on *Iva ciliata*.

On *Franseria discolor* Nutt. (?). S. M. Tracy, September 10, 1887, Denver, Arapahoe County, Colo. Conidia on stems and leaves, oöspores mature, in leaves.

On *Ambrosia artemisiæfolia*, L. A. B. Seymour, August 12, 1885, Granville, Hampden County, Mass. Conidia and mature oöspores on leaves.

On *Ambrosia* (sp. ?). S. M. Tracy, June 21, 188–, Coolidge, Bernalillo County, N. Mex. Conidia only, on leaves.

On *Artemisia biennis*, Willd. B. D. Halsted, 1885, Spirit Lake, Dickinson County, Iowa. Conidia only, on leaves.

On *Senecio serra*, Hook., var. *integriusculus*, Gr. F. D. Kelsey, July 9, 1888, Helena, Lewis and Clarke County, Mont. Conidia and mature oöspores in leaves.

On *Cnicus horridulus*, Pursh. W. T. Swingle, No. 4004, May 22, 1891, Norfolk, Norfolk County, Va. Conidia and mature oöspores in leaves.

On *Cnicus lanceolatus*, Hoffm. G. W. Clinton, 18—, Buffalo, Erie County, N. Y. Conidia only, on leaves.

On *Tragopogon pratensis*, L. W. A. Kellerman, No. 10[h], July 15, 1880, Göttingen, Germany. Conidia only, on leaves.

On *Tragopogon porrifolius*, L. G. W. Clinton, 18—, Buffalo, Erie County, N. Y. Conidia only, on leaves.

4. Albugo ipomœæ-panduranæ (Schweinitz) Swingle.

1822. *Aecidium Ipomoeae-panduranae*, Schweinitz. Synopsis fung. Carol. No. 454. <Schriften der naturforschenden Gesells. zu Leipzig, Bd. 1, p. 69.

1889. *Cystopus ipomoeae-panduranae* (Schw.) Stevs. & Swingle. List of Kansas species of Peronosporaceae, No. 2. <Trans. 20th and 21st meetings Kan. Acad. Sci., vol. xi, p. 67.

Conidia on leaves and stems, oöspores in stems and petioles of Convolvulaceæ.

On *Convolvulus?* (sp. ?). Conidia only, on leaves. W. T. Swingle, No. 4005, July 8, 1891, Eldorado, Lake County, Fla. Conidia only, on leaves. W. T. Swingle, No. 4006, July 13, 1891, Eldorado, Lake County, Fla. Conidia only, on leaves.

On *Ipomœa Batatas*, Lam. D. G. Fairchild, September 17, 1889, Vineland, Cumberland County, N. J. Conidia only, on leaves.

On *Ipomœa commutata*, R. and S. W. T. Swingle, No. 4007, June 15, 1891, Griffin, Spalding County, Ga. Conidia only, on leaves, stems, and peduncles. A. B. Langlois, No. 602, August 6, 1886, Pointe à la Hache, Plaquemine Parish, La. Conidia only, on leaves.

On *Ipomœa hederacea*, Jacq. Erwin F. Smith, July 9, 1890, Talbot County, Ga. Conidia only, on leaves. A. B. Langlois, No. 598, July 27, 1886, Pointe à la Hache, Plaquemines Parish, La. Conidia only, on leaves.

On *Ipomœa incarnata*, Vahl. C. S. Sheldon, No. 230, July 28, 1891, Quanah, Indian Territory, com., J. M. Holzinger. Conidia only, on leaves and stems. Mr. J. M. Holzinger kindly called my attention to this new host for the species. Only two plants were sent by Mr. Sheldon, and both showed the unusually large sori on the stems and on nearly all the leaves.

On *Ipomœa leptophylla*, Torr. E. Bartholomew, No. 433, July 20, 1891, Rockport, Rooks County, Kans. Conidia on swollen stems and leaves, immature oöspores in swollen stems.

On *Ipomœa pandurata*, Meyer. S. M. Tracy, July 1, 1888, Starkville, Oktibbeha County, Miss. Conidia only, on leaves. M. B. Waite, No. 258, September 10, 1888, Oregon, Ogle County, Ill. Oöspores only, in swellings on stems and leaves. The leaves often show a number of spots 5–20 mm. in diameter that are bulged and corrugated and literally filled with nearly mature oöspores. Possibly the leaf spots would have shown some conidia earlier in the season. E. M. Fisher, No. 201, September, 1890, Urmeyville, Johnson County, Ind. Conidia and nearly or quite mature oöspores in bullated corrugated spots on the leaf. Much like Waite's, No. 258.

On *Ipomœa lacunosa*, L. L. F. Ward, Sept. 7, 1879, Alexandria County, Virginia. Conidia only, on leaves.

On *Ipomœa* (sp?). S. M. Tracy, September 13, 1888, Durant, Holmes County, Miss.

5. Albugo platensis (Spegazzini) Swingle.

1883. *Cystopus amarantaccarum*, Zalewski. Zur Kennt. der Gatt. Cystopus Lév. Vorläufige Mittheilung. <Bot. Centralb., iv Jahrg. 1883, iii quartal Bd. xv, p. 223, pro parte.

1891. *Cystopus platensis*, Spegazzini. Phycomyceteae Argentinae, No. 15. <Revista Argentina de Historia Natural, tomo I, entrega 1ª, Buenos Aires, Feb. 1.º, 1891, p. 32.

Conidia on upper surface of leaves of Nyctaginaceæ. No oöspores found.

On *Allionia incarnata* L. S. M. Tracy, June 18, 1887, dry hills, 1 mile east of Albuquerque, Bernalillo County, N. Mex. Bilimek, No. 167, Sept. 21, 1869, Chapultepek, Mexico, Ex. Herb. Bot. Div. Dept. Agric. From Herb. Mus. Paris.

On *Boerhaavia diffusa*, (?) L. Newberry in McComb's expedition, sandy river bottoms, 1859, N. Mex., Colo., or Utah. Ex. Herb. Bot. Div. Dept. Agric.

On *Boerhaavia erecta*, L. Schott, No. 478, June 12, 1865, Merida, Yucatan, Mexico. Ex. Herb. Div. Bot. Dept. Agric. Edward Palmer, 1885, S. W. Chihuahua, Mexico. Ex. Herb. Bot. Div. Dept. Agric. Edw.

Palmer, No. 680, 1887, Los Angeles Bay, Guaymas, Mexico. Ex. Herb. Bot. Div. Dept. Agric. J. H. Simpson, July 11, 1890, Sarasota Bay, Manatee County, Fla. Ex. Herb. Bot. Div. Dept. Agric. W. T. Swingle, No. 4008, July 4, 1891, Eldorado, Lake County, Fla. W. T. Swingle, No. 4009, July 13, 1891, common on sandy land along railroad, Eldorado, Lake County, Fla.

On *Boerhaavia hirsuta*, Willd. Schott, No. 21, Feb. 12, 1865, Merida, Yucatan, Mexico. Ex. Herb. Bot. Div. Dept. Agric. W. T. Swingle, No. 4010, July 13, 1891, Eldorado, Lake County, Fla. The host may not be this species, as it was too young for positive determination.

On *Boerhaavia Sonoræ*, Rose. Edw. Palmer, September 16–30, 1890, Alamos de Calorce, Mexico. Ex. Herb. Bot. Div. Dept. Agric.

On *Boerhaavia spicata*, Choisy. Geo. Vasey, 1881, Las Cruces, N. Mex. Ex. Herb. Bot. Div. Dept. Agric.

On *Boerhaavia viscosa*, Lag. et Rodr. Reverchon, No. 791, June, 1880, Dallas, Dallas County, Tex. Ed. Palmer, No. 212, Aug. to Nov., 1885, S. W. Chihauhua, Mex.

On *Boerhaavia Xanthii*, Watson. Edw. Palmer, No. 681, 1887, Guaymas, Sonora, Mexico. Ex. Herb. Bot. Div. Dept. Agric.

I found this interesting *Albugo* in Florida during the summer of 1891, and upon my return to Washington examined the specimens of Nyctaginaceæ in the herbarium of the botanical division of the Department of Agriculture, through the kindness of Dr. George Vasey and Mr. J. N. Rose. I was agreeably surprised to find many specimens here, as may be seen from the foregoing list. I am much in doubt as to the identification of the material, and would not publish this notice if it were not largely with the hope that it may call forth further observations and perhaps result in the finding of oöspores.

The first mention I have found of *Albugo* occurring on nyctaginaceous plants is by Zalewski,* in 1883, who reports an *Albugo* on Boerhaavia from Ceylon and from La Plata which he refers to his *Cystopus amarantaccarum* (=*Albugo amaranthi* (Schw.) O. Kze.), on the strength of the conidial characters, since he was unable to find oöspores. In speaking of this form he says: "die Conidien sind aber hier von denen von C. Amarantacearum gar nicht zu unterscheiden." I find, however, that the specimens reported above (also lacking oöspores) seem to differ constantly from *Albugo amaranthi* in several points. First, the conidia are in every case yellowish as seen in mass, being almost exactly of the color of those of *A. portulacæ* and unlike those of *A. amaranthi*, which are white. Second, the terminal conidium shows in every case a very much thicker internal equatorial band which is dusky or even brown in color, while a similar structure in *A. amaranthi* is colorless or nearly so. Very possibly further differences will be found to exist, since I have not had time to make an exhaustive examination of the two species. These constant differences, together with the failure to find oöspores in

* Zur Kennt. der Gatt. Cystopus Lév. Vorläufige Mitt. in Bot. Centralb., loc. cit., pp. 222–223.

all specimens studied and the fact that the fungus is parasitic on a different, although related, family of plants, make me hesitate to refer it to *A. amaranthi.*

In 1880 Spegazzini* included in *Cystopus cubicus* (= *Albugo tragopogonis* (Pers), O. Kze.), a form occurring on leaves of *Boerhaavia erecta* found at Barracas del Sur, Argentine. Our species, however, appears to differ from *A. tragopogonis* in at least the following ways: First, in having spores yellowish in mass; second, in having the terminal conidia smaller than the others; and, third, in the conidia having a dusky-brown equatorial band. Besides this the families of the host plants are not at all closely related, and from this fact alone it is probable that the species are distinct.

The next reference I find to an Albugo on Nyctaginaceæ is by Spegazzini,† who, in 1891, described a new species, *Cystopus platensis*, on Boerhaavia from Argentine. As his description may not be accessible to all interested, I quote in full:

15. Cystopus platensis Speg. (n. sp.)–Fung., Arg. pug. I, n. 68 (sub *C. cubico*).

Hab. In foliis vivis *Boerhaviae hirsutae* prope Buenos Aires (1880), et prope Córdoba (1887).

Obs. Sori hypophylli macula primo pallescente dein purpurascente cincti, irregulares minuti (1–2 mllm. diam.) sparsi v. hinc inde laxe gregarii, vix prominuli candidi diu epidermide velati, dein erumpentes ac pulverulenti; conidia globoso-cuboidea (20–22 × 18–20μ) hyalina catenulata, minute densissimeque punctulata (an tantum granuloso farcta?), suprema ovata obtusa; cellulae basales steriles obconico-turbinatae (40–45 × 12–15μ) crasse tunicatae per aetatem flavescentes. Oosporae ignotae. Species praecedenti [*C. bliti* on Amaranthaceæ] peraffinis sed conidiis punctulatis majoribus satis, ut videtur, recedens.

The conidia of the preceding species are given as 16–18 × 15–17μ.

6. **Albugo amaranthi** (Schweinitz) O. Kuntze. Rev. gen. Pl. I, vol. II. p. 658, footn. 1.

1834. *Caeoma* [§ *Uredo* (*Albugo*)] *Amaranthi*, Schw. Syn. fung. Am. Bor.,No. 2853. <Trans. Am. Phil. Soc., Phila., new ser., vol. IV, p. 292.

1874. *Cystopus Amaranthi* (Schw.) Berkeley. Notices of N. Am. Fungi, No. 571. <Grevillea, vol. III, London, No. 26, December, 1874, p. 58.

Conidia and oöspores in leaves of Amarantaceæ.

On *Amarantus chlorostachys*, Willd. W. T. Swingle, No. 4011, June 26, 1891, Baldwin, Duval County, Fla. Conidia only, on leaves.

On *Amarantus chlorostachys*, var. *hybridus*. Wats. E. M. Fisher, No. 84, July 25, 1890, Urmeyville, Johnson County, Ind. Conidia and mature oöspores in leaves. E. M. Fisher, No. 84, August, 1890, Urmeyville, Johnson County, Ind. Conidia and mature oöspores in leaves.

On *Amarantus crispus*, Braun. S. M. Tracy, May 26, 1888, Starkville, Oktibbeha County, Miss. Conidia and mature oöspores in leaves.

On *Amarantus spinosus*, L. W. T. Swingle, No. 4012, June 26, 1891, Baldwin, Duval County, Fla. Conidia and mature oöspores in leaves.

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* Spegazzini, Fungi Argentini. Pugillus primus, No. 67. <Ann. Soc. Cientifica Argentina, tomo IX, Abril de 1880, Buenos Aires, p. 177.

† Spegazzini, Dr. Carolus. Phycomyceteae Argentinæ. <Revista Argentina de Hist. Nat., t. I, Buenos Aires, Feb. 1, 1891, p. 32.

On *Amarantus retroflexus*, L. E. M. Fisher, No. 37, July 18, 1890, Urmeyville, Johnson County, Ind. Conidia only, on leaves. C. A. Hart, August 2, 1883, Quincy, Adams County, Ill. Conidia and mature oöspores in leaves. E. M. Fisher, No. 37, August, 1890, Urmeyville, Johnson County, Ind. Conidia only, on leaves. M. B. Waite, No. 124, August 8, 1885, Oregon, Ogle County, Ill. Conidia and mature oöspores in leaves. E. Bartholomew, No. 88, August 10, 1888, Rockport, Rooks County, Kans. Conidia and mature oöspores in leaves. J. J. Davis, September 3, 1887, Racine, Racine County, Wis. Conidia only, on leaves. M. B. Waite, (Herb. Div. Veg. Path. No. 45), September 5, 1889, Lansing, Ingham County, Mich. Conidia and mature oöspores in leaves.

On *Amarantus* (sp. ?). G. W. Clinton, 18—, Buffalo, Erie County, N. Y. Conidia and oöspores in leaves. T. A. Williams, No. 324, July 15, 1890, Ashland, Saunders County, Nebr. Conidia and mature oöspores in leaves.

7. Phytophthora infestans (Montaigne) De Bary. Research into Nature of Potato Fungus. <Jour. Roy. Agric Soc., 2d ser., vol. XII, London, 1876. pp. 239–269.

1845. *Botrytis infestans*, Montaigne. <Jour. l'Inst., 1845, p. 313; also <Bull. Soc. Philomath. de Paris. Séance du 30 Août, 1845.

On leaves of Solanaceæ.

On *Solanum tuberosum*, L. A. B. Seymour (No. 5623, Herb. Ill. State Lab. Nat. Hist.), August 7, 1882, Camp Point, Adams County, Ill. E. A. Southworth, September 15, 1891, Smiths Mills, Chautauqua County, N. Y. W. T. Swingle, No. 4013, September 20, 1891, Garrett Park, Montgomery County, Md. This fungus was quite abundant in a field at this place and seriously injured at least the tops of the plants.

8. Sclerospora graminicola (Saccardo) Schroeter. Die Pilze Schlesiens I, 1886, p. 236, No. 352.

1876. *Protomyces graminicola*, Saccardo. Fungi venetinovi vel critici ser. VI, No. 91, <Nuovo giorn. bot. ital., vol. VIII, 1876, p. 172.

On leaves and inflorescences of Gramineæ.

On *Setaria viridis*, Beauv? Tom A. Williams, No. 257, August, 1889, Weeping Water, Cass County, Nebr. Conidia (?) and oöspores in leaves and in the distorted spikelets.

9. Plasmopara pygmæa (Unger) Schroeter. Die Pilze Schlesiens, I, 1886, No. 359, p. 239.

1833. *Botrytis pygmaea* Unger. Die Exanthemen der Pflanzen, pp. 172–173.

On leaves of Ranunculaceæ. Conidiophores hypophyllous on radical leaves.

On *Anemone Pennsylvanica*, L. C. A. Hart, May, 1884, Normal, McLean County, Ill.

On *Hepatica acutiloba*, DC. J. J. Davis, May 13, 1887, Racine, Racine County, Wis.

10. Plasmopara geranii (Peck). Berl. & De Toni. <Sacc. Sylloge fungorum, vol. VIII, Part I, 1888, p. 242, No. 811.

1879. *Peronospora Geranii*, Peck. Rept. Botanist, in 28th Rept. N. Y. State Mus. Nat. Hist., p. 63.

On leaves of Geraniaceæ. Conidiophores always hypophyllous.

On *Geranium Carolinianum*, L. S. M. Tracy, March 11, 1888, Starkville, Oktibbeha County, Miss. M. B. Waite, No. 553, March 17, 1889, High Island, Montgomery County, Md. M. B. Waite, No. 555, April 10, 1889, High Island, Montgomery County, Md. F. S. Earle, April 28, 1883, Anna, Union County, Ill. Erwin F. Smith, May 11, 1889, dry fields, Still Pond, Kent County, Md. B. T. Galloway, May 17, 1891, Garrett Park, Montgomery County, Md. D. G. Fairchild, May 21, 1889, New Brunswick, Middlesex County, N. J. W. T. Swingle, No. 4014, May 22, 1891, Norfolk, Norfolk County, Va. B. T. Galloway, May 23, 1877, Boone County, Mo.

On *Geranium maculatum*, L. B. T. Galloway, July 4, 1888, Washington, D. C. With a few nearly mature oöspores in leaves.

11. Plasmopara obducens. Schroeter. Die Pilze Schlesiens, I. p. 238. 1886. No. 356.

1877. *Peronospora obducens*, Schroeter. <Hedwigia Bd. xvi, 1877, No. 9, p. 129–135.

On leaves and cotyledons of Geraniaceæ. Conidiophores hypophyllous.

On *Impatiens fulva*, Nutt. E. M. Fisher, No. 55, July 22, 1890, Needham, Johnson County, Ind. With very immature oöspores in leaves.

On *Impatiens* (sp.?). (*I. fulva* or *I. pallida*.) M. B. Waite, No. 551, April 10, 1889, Rosslyn, Alexandria County, Va. B. T. Galloway, May 3, 1891, Garrett Park, Montgomery County, Md. C. A. Hart, May 10, 1884, Bloomington, McLean County, Ill. J. J. Davis, May 15, 1887, Racine, Racine County, Wis. P. H. Dorsett, May 21, 1891, Benning's Station, Md.

12. Plasmopara viticola (Berkeley & Curtis) Berl. & De Toni. <Saccardo, Sylloge fungorum, vol. VII. Part I. p. 239. No. 806. 1888.

1860. *Botrytis viticola*, Berk. & Curt. <Ravenel Fungi Caroliniani Exsiccati. Fungi of Carolina, illustrated by natural specimens of the species, by H. W. Ravenal, Charleston. Cent. V., No. 90.

On leaves of Vitaceæ.

On *Vitis æstivalis*, Michx. M. B. Waite, No. 123, August 3, 1885, Oregon, Ogle County, Ill. M. B. Waite, No. 182, September 10, 1889, Oregon, Ogle County, Ill. M. B. Waite, No. 544, September 15, 1888, Oregon, Ogle County, Ill. W. T. Swingle, No. 4015, October 10, 1891, Still Pond, Kent County, Md.

On *Vitis cinerea*, Engelm. (?) E. M. Fisher, No. 89, July 18, 1890, Urmeyville, Johnson County, Ind.

On *Vitis cordifolia*, Michx. C. A. Hart, July 18, 1883, La Grange, Lewis County, Mo. E. M. Fisher, No. 89, July 26, 1890, Urmeyville, Johnson County, Indiana. Herman Jaeger, August 20, 1888, Neosho, Newton County, Mo. F. S. Earle and M. B. Waite, September 19, 1885, Urbana, Champaign County, Ill. W. T. Swingle, No. 4016, October 10, 1891, Still Pond, Kent County, Md.

On *Vitis* (cultivated, hort. var. Concord). M. B. Waite, No. 273, July

23, 1888, Champaign, Champaign County, Ill. M. B. Waite, No. 545, September 25, 1888, Urbana, Champaign County, Ill.

On *Vitis* (cultivated, hort. var. Clinton). S. M. Tracy, August 23, 1887, Plattville, Grant County, Wis.

On *Vitis* (cultivated, hort. var. Niagara). H. L. Rogers, July 17, 1890, Highland, Ulster County, N. Y.

On *Vitis* (cultivated, var. unknown). B. T. Galloway, September, 1888, Dept. Agric. Grounds, Washington, D. C. M. B. Waite (Herb. Div. Veg. Path., No. 359), September 18, 1889, Champaign, Champaign County, Ill. E. M. Fisher, No. 186, September, 1890, Franklin County, Ind. With mature oöspores in leaves. W. T. Swingle, No. 4017, October 10, 1891, Still Pond, Kent County, Md. I am not certain this was a cultivated grape, as it grew by the roadside, but it seemed unlike any wild grape I know.

13. Plasmopara australis (Spegazzini) Swingle. A list of the Kansas species of Peronosporaceae No. 9. <Trans. Twentieth and Twenty-first Meeting Kans. Acad. Sci., vol. XI, 1889, p. 72.

1881. *Peronospora australis* Spegazzini. Fungi Argentini, Pugillus I, No.—. <Anales d. l. sociedad cientifica argentina, t. XII, 1881, p. 81.

On leaves of Cucurbitaceæ. Conidiophores always hypophyllous on cauline leaves.

On *Sicyos angulatus*, L. B. T. Galloway, June, 1887, Boone County, Mo. B. T. Galloway, July 25, 1886, Boone County, Mo. E. M. Fisher, No. 171, September, 1890, Needham, Johnson County, Ind.

14. Plasmopara viburni Peck. Ann. Rep. State Botanist of New York, p. 28. Reprint from 43d Rept. N. Y. State Mus. Nat. Hist., Albany, 1890.

On leaves of Caprifoliaceæ. Conidiophores hypophyllous on cauline leaves.

On *Viburnum acerifolium*, L. M. B. Waite, No. 535, October 11, 1891, Cascade Run, Washington, D. C.

On *Viburnum opulus*, L. D. G. Fairchild, September 28, 1889, Breese Hill, Md. D. G. Fairchild, October, 1889, Breese Hill, Md.

15. Plasmopara entospora (Roze and Cornu). Berl. and DeToni. <Saccardo Sylloge fungorum, vol. VII, Part I, p. 239, No. 805.

1867. *Basidiophora entospora* Roze and Cornu. Sur deux nouv. types d. Saproleg. <Ann. d. Sci. Nat. 5e sér. Bot., t. XI, 1869, pp. 84–89 (pp. 13–18 of reprint), Pl. 4.

On leaves of Compositæ, tribe Asteroideæ. Conidiophores hypophyllous on both radical and cauline leaves.

On *Aster Novæ-Angliæ*, L. W. T. Swingle, No. 4018, October 29, 1891, Garrett Park, Montgomery County, Md. Conidiophores on cauline leaves. Abundant.

On *Erigeron Canadense*, L. M. B. Waite, No. 121, May 13, 1885, Urbana, Champaign County, Ill. Conidiophores and abundant mature oöspores on cauline leaves.

16. Plasmopara Halstedii (Farl.) Berl. and DeToni. <Sacc. Syll. Fung., vol. VII, Part I, p. 242, No. 810.

1878. *Peronospora Halstedii*, Farlow. Notes on some species in the Third and Eleventh Centuries of Ellis's N. Am. Fungi. <Proc. Am. Acad. Arts and Sci., vol. XVIII, new series, vol. X, 1878, p. 72.

On leaves of Compositæ. Conidiophores hypophyllous on cauline leaves.

On *Erigeron Philadelphicum*, L. (?). B. T. Galloway, September 25, 1891, Garrett Park, Montgomery County, Md.

On *Erigeron* (sp. ?). E. W. D. Holway, July 20, 1884, Decorah, Winneshiek County, Iowa.

On *Silphium perfoliatum*, L. M. B. Waite, No. 265, September 8, 1888, Oregon, Ogle County, Ill. S. M. Tracy, September 1, 1888, Plattville, Grant County, Wis. With mature oöspores on cauline leaves.

On *Ambrosia artemisiæfolia*, L. W. T. Swingle, No. 4019, September 20, 1891, Garrett Park, Montgomery County, Md.

On *Ambrosia trifida*, L. E. A. Southworth, May 1, 1891, College Station, Prince George's County, Md. B. T. Galloway, May 13, 1888, Virginia. C. G. Hart, May 14, 1884, Normal, McLean County, Ill. P. H. Dorsett, May 16, 1891, Benning's Station, Md. M. B. Waite, No. 266, May 19, 1888, Urbana, Champaign County, Ill. M. B. Waite, No. 541, June 1, 1888, Oregon, Ogle County, Ill. C. A. Hart, July 18, 1883, La Grange, Lewis County, Mo. T. A. Williams, No. 256, August 1, 1889, Wabash County, Nebr.

On *Helianthus grosse-serratus*, Martens. M. B. Waite, No. 546, May 28, 1888, Oregon, Ogle County, Ill. Conidiophores forming a dense white coating.

On *Helianthus* (sp. ?). C. A. Hart, May, 1884, Normal, McLean County, Ill. Conidiophores attacking only the basal portion and there forming a dense white coating. M. B. Waite (Herb. Div. Veg. Path., No. 318) September 4, 1891, Oregon, Ogle County, Ill. Conidiophores on cauline leaves in rather scattered spots. F. L. Scribner, July 17, 1887, Lanier Heights, Washington, D. C. Conidiophores forming a very dense white coating on the basal portion of the diseased leaves.

On *Bidens connata*, Muhl. E. M. Fisher, No. 188, September, 1890, Urmeyville, Johnson County, Ind.

On *Bidens frondosa*, L. E. M. Fisher, No. 58, July 20, 1890, Urmeyville, Johnson County, Ind. E. M. Fisher, No. 59, August, 1890, Urmeyville, Johnson County, Ind.

On *Erechthites hieracifolia*, Raf. M. B. Waite, No. 122, August 11, 1885, Oregon, Ogle County, Ill.

17. Plasmopara gonolobi (Lagerheim) Swingle.

1891 *Peronospora gonolobi*, Lagerheim. Observations on new species of fungi from North and South America. <Jour. of Mycol., Vol. VII, p. 49.

On leaves of Asclepiadaceæ.

On *Gonolobus suberosus*, R. Br. W. T. Swingle, No. 4001, Oct. 10, 1891, Still Pond, Kent County, Md. Conidiophores only, hypophyllous. Prof. W. G. Farlow has kindly compared my specimens with a part of those from which Prof. Lagerheim described the species and pronounces them identical. The species has the typical branching of *Plasmopara*. The conidia germinate readily in water producing zoöspores which have two cilia.

Measurements of sixty conidia are herewith appended.

Table of measurements of sixty conidia of Plasmopara gonolobi (Lagerheim), Swingle.*

16½ by 15	19⅛ by 17½	22½ by 18	25 by 20
16⅝ by 16⅛	20 by 17	22½ by 18	25½ by 18
18 by 15	21 by 15⅝	22⅝ by 19½	25⅝ by 18
18 by 15	21 by 16⅛	22½ by 19⅛	25⅝ by 18⅝
18 by 16⅛	21 by 16⅝	22⅝ by 20⅝	25⅛ by 19⅛
19⅛ by 14½	21 by 17½	23 by 19	25⅛ by 19⅛
19⅛ by 15⅝	21 by 17½	24 by 15⅝	25⅛ by 21⅝
19⅛ by 15⅝	21 by 17½	24 by 19⅛	25⅛ by 22½
19⅛ by 16	21 by 18	24 by 19⅛	25⅛ by 24⅝
19⅛ by 16½	21 by 18¾	24 by 19⅛	26½ by 21
19⅛ by 16⅛	21 by 19⅛	24 by 19⅛	27 by 19½
19⅛ by 16⅛	21⅝ by 16⅛	24 by 20½	27 by 21
19⅛ by 16⅛	21⅝ by 18	24 by 21	27 by 21
19½ by 16⅛	21⅝ by 18¾	24⅝ by 18⅝	34½ by 24⅝
19½ by 16⅝	22½ by 18	24⅝ by 19	42 by 26

18. Bremia lactucæ, Regel. Beiträge z. Kennt. einiger Blattpilze. Bot. Zeit., 1843, p. 665.

On leaves of Compositæ, Tribe Cichoriaceæ. Conidiophores hypophyllous, on both radical and cauline leaves.

On *Krigia Dandelion*, Nutt. F. S. Earle, May 10, 1884, Cobden, Union County, Ill.

On *Lactuca Canadensis*, L. B. T. Galloway, June 1887, Columbia, Boone County, Mo.; W. A. Kellerman, No. 29, June 6, 1882, Lexington, Fayette County, Ky.; M. B. Waite, No. 120, August 26, 1885, Oregon, Ogle County, Ill.

On *Lactuca integrifolia*, Bigel. W. T. Swingle, No. 4020, September 20, 1891, Garrett Park, Montgomery County, Md.

On *Lactuca leucophæa*, Gray. W. T. Swingle, No. 4021, October 29, 1891, Rockville, Montgomery County, Md.

On *Lactuca sativa*, L. E. A. Southworth, December 8, 1891, Reeves Station, Md.

On *Lactuca* (sp.?). P. H. Dorsett, May 21, 1891, Benning's Station, Md.; F. S. Earle, June 17, 1883, Anna, Union County, Ill.; W. T. Swingle, No. 4022, September 17, 1891, Sterling, Loudoun County, Va.; M. B. Waite, (Herb. Div. Veg. Path. No. 525), September 27, 1889, Mt. Carmel, Wabash County, Ill.; W. T. Swingle, No. 4023, October 25, 1891, Bethesda Park, Montgomery County, Md.

PERONOSPORA.

Corda, Icones fungorum hucusque cognitorum, I, p. 20.

§ *Calothecæ.*

19. Peronospora arenariæ (Berkeley) Tulasne, Note sur les champignons entophytes, tels que celui de la Pomme de terre. <Compt. Rend. d. l'Acad. d. Sciences, t. 38, 26 Juin, 1854, p. 1102 and 1103.

* These conidia were measured from fresh specimens (from Still Pond, Md., coll. Oct. 10, 1891) in water by Miss May Varney with a Zeiss F. obj. 3 oc. 169 mm. tube length. One division of the eyepiece micrometer equaled 1½ μ's. The measurements are given in μ's.

1846. *Botrytis arenariæ* Berkeley. Observations, Botanical and Physiological, on the Potato Murrain. Journ. Hort. Soc. London, vol. 1, p. 31, pl. 4, f. 22.
Var. **macrospora** Farlow. Additions to the Peronosporeæ of the United States, No. 12*, Bot. Gaz., vol. IX, No. 3, Mar., 1884, p. 38.

On *Silene* sp. (?). F. S. Earle, April 24, 1884, Anna, Union County, Ill. As no oöspores were seen the identification of this specimen is somewhat doubtful.

20. **Peronospora alsinearum** Caspary. Ueber einige Hyphomyceten mit zwei-und dreierlei Früchten. No. 8. <Bericht über die zur Bekanntmachung geeigneten Verhandlungen K. Preuss. Ak. der Wissensch. zu Berlin, 1855. Berlin, Sitzung phys. math. Klasse vom 14. Mai, 1855, p. 330.

On *Cerastium nutans* Raf. M. B. Waite, No. 262, May 19, 1888, Urbana, Champaign County, Ill. With mature oöspores in lower leaves.

On *Cerastium viscosum* L. (?). S. M. Tracy, April 1, 1888, Starkville, Oktibbeha County, Miss. With mature oöspores in stems.

On *Cerastium vulgatum*, L. S. M. Tracy, April 4, 1888, Starkville, Oktibbeha County, Miss. Conidophores very scarce, oöspores mature and abundant in stems, leaves, and calyces.

21. **Peronospora viciæ** (Berkeley) Caspary. Ueber einige Hyphomyceten mit zwei-und dreierlei Früchten. <Bericht über die zur Bekanntmachung geeigneten Verh. K. Preuss. Ak. der Wissensch. zu Berlin, 1855. Sitzung. der physik. math. Klasse vom 14. Mai, 1855, p. 330.

1846. *Botrytis Vicia* Berkeley. Observations, Botanical and Physiological, on the Potato Murrain. <Jour. Hort. Soc. of London, vol. I, p. 31, pl. 4, fig. 23.

On leaves, stems, and inflorescences of Leguminosæ, suborder Papilionaceæ, tribe Vicieæ.

On *Vicia sativa* L. W. T. Swingle, No. 4031, May 22, 1891, along drainage ditches by roadsides, east of Norfolk, Norfolk County, Va.

On *Vicia* (sp.?). E. A. Southworth, January 13, 1890, Washington, D. C.

22. **Peronospora calotheca** De Bary. Rabenhorst, <Klotzschii herb. viv. myc., ed. 2, Cent. VII, No. 673 1858; also <Botanische Zeit., XVI Jahrg., 1858, p. 58.

On leaves of Rubiaceæ.

On *Galium aparine* L. M. B. Waite, No. 267, May 12, 1888, Urbana, Champaign County, Ill. M. B. Waite, No. 547, May 29, 1888, Urbana, Champaign County, Ill. With mature oöspores in leaves and stems. E. W. D. Holway, June 7, 1884, Decorah County, Iowa.

23. **Peronospora Arthuri** Farlow. Enumeration of the Peronosporeæ of the United States, No. 13, <Bot. Gaz., vol. VIII, October, 1883, p. 315.

On leaves of Onagraceæ.

On *Œnothera biennis*, L. E. A. Southworth, May 1, 1891, College Station, Prince George County, Md. C. A. Hart, May 15, 1883, Normal, Union County, Ill. E. W. D. Holway, June 7, 1884, Decorah, Winneshiek County, Iowa. M. B. Waite, No. 539, June 22, 1885, Oregon, Ogle County, Ill. M. B. Waite, No. 262, July 4, 1888, Champaign, Champaign County, Ill. With mature oöspores in leaves.

24. **Peronospora myosotidis** De Bary. <Rabenhorst, Fungi europæi. No. 572.

On leaves of Borraginaceæ.

On *Myosotis verna*, Nutt. F. S. Earle, April 24, 1884, Anna, Union County, Ill. With abundant mature oöspores in stems.

§ *Leiothecæ:* Subsection *parasiticæ.*

25. Peronospora corydalis De Bary. Rech. s. le développm. de quelq. cham. parasites. <Ann. Sci. Nat., 4ᵉ. sér., Bot. t. xx, cahier. 1, Paris, 1863, p. 111, (p. 107 of the reprint).

On leaves of Fumariaceæ.

On *Corydalis* sp. (?). B. T. Galloway, May 6, 1888, Rock Creek, Washington, D. C.

On *Dicentra cucullaria*, DC. M. B. Waite, No. 554, April 20, 1889, High Island, Montgomery County, Md. With mature oöspores in leaves.

26. Peronospora parasitica (Persoon). Fries Summa veg. scand. sect. post., p. 493 (1849).

1796. *Botrytis parasitica* Persoon. Obs. mycologicæ pars. I, p. 96, t. 5, figs. 5, *a*, *b*.

On leaves and stems of Cruciferæ.

On *Dentaria heterophylla*, Nutt. M. B. Waite, No. 549, April 14, 1889, Roslyn, Alexandria County, Va.

On *Dentaria laciniata*, Muhl. E. A. Southworth, April 25, 1891, Rock Creek, Washington, D. C. With immature oöspores on leaves. B. T. Galloway, May 3, 1891, Garrett Park, Montgomery County, Md. With mature oöspores in leaves. M. B. Waite, No. 537, May, 1888, Oregon, Ogle County, Ill. Erwin F. Smith, May 8, 1889, Still Pond, Kent County, Md., with immature oospores in leaves! Some of the conidiophores have a very thick unbranched basal portion, as much as 25 μ in diameter at the base in several cases. J. J. Davis, May 20, 1887, Racine, Racine County, Wis. With immature oöspores in leaves. M. B. Waite, No. 268, June 1, 1888, Oregon, Ogle County, Ill. With mature oöspores in leaves. W. G. Clinton, 18—, Buffalo, Erie County, N. Y.

On *Draba Caroliniana* Walt. M. B. Waite, No. 269, June 1, 1888, Oregon, Ogle County, Ill. With mature oöspores in leaves.

On *Sisymbrium canescens* Nutt. Francis A. Wentz, summer, 1886 (?), Spearville, Ford County, Kans. With nearly mature oöspores in stems.

On *Lepidium intermedium* Gray. T. A. Williams, No. 287, May 30, 1890, Ashland, Saunders County, Nebr. With conidiophores on leaves, and abundant mature oöspores in leaves (!) and stems.

On *Lepidium Virginicum* L. M. B. Waite, No. 548, May 28, 1888, Oregon, Ogle County, Ill. With mature oöspores in leaves.

On *Arabis Holbœllii*, Hornem. S. M. Tracy, No. 720, August 20, 1887, Marshall Pass, Saguache County, Colo.

27. Peronospora potentillæ De Bary. Rech. s. l. développm. de quelq. champ. parasites. <Ann. Sci. Nat., 4ᵉ sér. Bot., t. xx, Paris 1863, p. 124 (p. 120 of the reprint).

On leaves of Rosaceæ, Tribe Potentillæ.

On *Geum album* Gmelin. E. M. Fisher, No. 68, July 22, 1890, Needham, Johnson County, Ind.

On *Potentilla Norvegica* L. E. A. Southworth, May 1, 1891, College

Station, Prince George's County, Md. B. T. Galloway, September 25, 1891, Garrett Park, Montgomery County, Md.

28. Peronospora oxybaphi Ellis & Kellerman. New Kansas Fungi. <Jour. Mycol., Vol. 1, Manhattan, Jan., 1885, p. 2.

On leaves and petioles of Nyctaginaceæ.

On *Oxybaphus nyctagineus*, Sweet. T. A. Williams, No. 286, May 30, 890, Ashland, Saunders County, Nebr. Conidiophores hypophyllous, on leaves, mature oöspores in petioles.

Subsection *effusæ*.

29. Peronospora ficariæ Tulasne. Note sur les champignons entophytes, tels que celui de la Pomme de terre. <Comptes Rend. d. l'Acad d. Sciences, t. 38, Paris, Séance du 26 Juin, 1854, p. 1102–1103.

On leaves of Ranunculaceæ.

On *Ranunculus bulbosus* L. A. B. Seymour, May 12, 1883, Cambridge, Middlesex County, Mass.

On *Ranunculus fascicularis*, M. B. Waite, No. 542, May 31, 1888, Oregon, Ogle County, Ill. Rare.

30. Peronospora violæ De Bary. Rech. s. l. développm. de quelq. champ. parasites, <Ann. Sci. Nat., 4e sér. Bot., t. xx, 1863, p. 125 (p. 121 of the reprint).

On leaves of Violaceæ.

On *Viola tricolor* L., var. *arvensis*. S. M. Tracy, April 5, 1888, Starkville, Oktibbeha County, Miss. With nearly or quite mature oöspores in leaves. F. S. Earle, April 13, 1884, Cobden, Union County, Ill. With mature oöspores in stems and leaves.

31. Peronospora hydrophylli Waite. Descript. of two new species of Peronospora. <Jour. Mycol., Vol. VII, No. 2, p. 107, pl. XVII, figs. 17–24.

On leaves of Hydrophyllaceæ.

On *Hydrophyllum Virginicum* L. M. B. Waite, No. 559, May 5, 1889, High Island, Montgomery County, Md. M. B. Waite, No. 558, June 1, 1888, Oregon, Ogle County, Ill. A. S. Hitchcock, spring, 1888, Iowa City, Johnson County, Iowa.

32. Peoronspora dispaci Tulasne. Note sur les champignons endophytes, tels que celui de la Pomme de terre, <Comptes Rend. de l'Acad. d. Sciences, t. 28, Paris, Séance du 26 Juin, 1854, p. 1102–1103.

On leaves of Dipsaceæ.

On *Dipsacus yylvestris* Mill. C. H. Demetrio, July, 1884, Muench farm, Saline Creek, near Perryville, Perry County, Mo.

33. Peronospora grisea Unger. <Bot. Zeit, 1847, p. 315.
1833, *Botrytis grisea* Unger. Die Exanthemen der Pflanzen, p. 172.

On leaves of Scrophulariaceæ.

On *Veronica arvensis* L. M. B. Waite, No. 541, May 7, 1883, Urbana, Champaign County, Ill. With abundant mature oöspores in leaves and stems.

34. Peronospora lophanthi Farlow. Enumeration of the Peronosporeæ of the United States, No. 31. <Bot. Gaz., Vol. VIII, No. 11, Nov., 1883, p. 333.

On leaves of Labiatæ.

On *Lophanthus nepetoides* Benth. M. B. Waite, No. 125, May 13, 1885, Urbana, Champaign County, Ill.

35. Peronospora lamii A. Braun. <Rabenhorst, Herb. Myc., Ed. 2, No. 325 (1859).

On leaves of Labiatæ.

On *Lamium amplexicaule*, L. W. T. Swingle, No. 4028, May 22, 1891, waste land in old fields 2 miles southeast of Norfolk, Norfolk County, Va. Conidiophores and nearly mature oöspores in leaves. I think these specimens should be referred to *Peronospora lamii*. About the only respect in which the Norfolk specimens differ from European collections I have examined is that the conidiophores are much more scanty. I have compared it with *P. lamii* in Krieger Fungi Sax, 195, on *Lamium purpureum*, L. from Konigsberg, Germany; de Thumen, Mycoth. universalis, No. 721, on *Lamium amplexicaule* from Pasma, Italy; and Saccardo, Mycoth. Veneta, No. 487, on *Lamium purpureum* from Vittorio, Italy.

36. Peronospora alta Fuckel. Fungi rhenani No. 39; Symbolae mycologicae, Beiträge zur Kenntniss der Rheinischen Pilze, p. 71. <Jahrb. Nassauischen Vereins für Naturk., Jahrg. 23 und 24.

On leaves of Plantaginaceæ.

On *Plantago Patagonica* Jacq., var. *aristata* Gr. W. T. Swingle, No. 4032, June 20, 1891, under the trees in a peach orchard, Griffin, Spalding County, Ga. The parasite was very abundant in one orchard on this host, which in some spots seemed to be seriously injured by it.

On *Plantago* Sp. (?) (*P. major* or *P. Rugelii*). M. B. Waite, No. 534, Oregon, Ogle County, Ill.; M. B. Waite, No. 261, June 8, 1888, Oregon, Ogle County, Ill.; J. J. Davis, June 15, 1887, Racine, Racine County, Wis.; E. M. Fisher, No. 60, July 20, 1890, Urmeyville, Johnson County, Ind.; E. M. Fisher, No. 60, September, 1890, Urmeyville, Johnson Couny, Ind.

37. Peronospora effusa (Greveille) Rabenhorst. Klotz. herb.viv. myc., No. 1880. 1824. *Botrytis effusa*, Greveille. <Flora edenensis, p. 468.

On leaves of Chenopodiaceæ.

On *Chenopodium album* L. M. B. Waite, No. 264, June 9, 1888, Oregon, Ogle County, Ill. With mature oöspores in dying leaves. M. B. Waite, No. 538, June 23, 1885, Oregon, Ogle County, Ill.; B. D. Halsted, July, 1885, Spirit Lake, Dickinson County, Iowa. With mature oöspores in leaves. W. T. Swingle, No. 4024, May 22, 1891, waste land east of Norfolk, Norfolk County, Va. E. M. Fisher, No. 196, September 17, 1890, Urmeyville, Johnson County, Ind.

38. Peronospora rumicis Corda. Icones fungorum hucusque cognitorum, t. i., p. 20, tab. v, f. 273.

On leaves of Polygonaceæ.

On *Polygonum dumetorum*, L. var. *scandens*, Gr. E. M. Fisher, No. 74, July 24, 1890, Urmeyville, Johnson County, Ind. M. B. Waite, No. 272, July 30, 1888, Champaign, Champaign County, Ill. E. M. Fisher, No. 74, September, 1890, Urmeyville, Johnson County, Ind.

39. Peronospora euphorbiæ Fuckel. Fungi rhenani No. 40; Symb. Myc., p. 71.

Conidia and oöspores on leaves and inflorescences at the ends of branches of Euphorbiaceæ.

On *Euphorbia humistrata* Engelm. J. M. Holzinger, No. 67, July 24, 1888, Winona, Winona County, Minn. Conidiophores abundant; hypophyllous on leaves and inflorescences.

On *Euphorbia cordifolia* Ell. E. Bartholomew, No. 435, August 15, 1891, Rockport, Rooks County, Kans. With immature oöspores in stems.

On *Euphorbia hirsuta* Engelm. E. Bartholomew, No. 434, August 10, 1891, Rockport, Rooks County, Kans. With immature oöspores in stems.

On *Euphorbia hypericifolia* L. W. T. Swingle, No. 4025, September 21, 1891. Low ground in a vineyard. Sterling, Loudoun County, Va. Conidiophores amphigenous on leaves. Oöspores sparing; immature in leaves. I found only a single plant attacked with the fungus; and of this plant but one small branch was affected. The leaves bore also *Æcidium euphorbiæ* Pers., and were thus doubly parasitized. The only other *Euphorbia* growing near (*E. corollata, L.*) seemed entirely free from Peronospora.

On *Euphorbia serpyllifolia* Pers. E. Bartholomew, No. 436, August 8, 1891, Rockport, Rooks County, Kans. With nearly mature oöspores in stems. J. M. Holzinger, No. 154, August 22, 1888, Winona, Winona County, Minn. Conidiophores very scarce, but leaves and inflorescences filled with nearly or quite mature oöspores.

§ doubtful.

40. Peronospora cubensis Berkeley & Curtis. Berkeley on a collection of fungi from Cuba, Part II, including those belonging to the families Gasteromycetes, Coniomycetes, Hyphomycetes, Physiomycetes. <Jour. Linn. Soc. Botany, Vol. 10, 1869, p. 363.

On leaves of Cucurbitaceæ.

On *Cucumis anguria.* T. L. Brunk, 1888, College Station, Brazos County, Tex. J. F. Howe, December 12, 1889, Anona, Hillsboro County, Fla.

On *Cucumis sativus.* T. L. Brunk, College Station, Brazos County, Tex. P. H. Dorsett, Garrett Park, Montgomery County, Md. This species did considerable damage this year to a small patch of cucumbers on rather low ground near Garrett Park, Md.

41. Peronospora celtidis Waite. Descript. of two new species of Peronospora. <Jour. Mycol., vol. 7, No. 2, p. 105, pl. XVII, figs. 1–16.

On leaves of Urticaceæ; tribe Celtideæ.

On *Celtis occidentalis* L. M. B. Waite, No. 556, October 7, 1891, Washington, D. C. With mature oöspores in leaves. M. B. Waite, No. 557, October 9, 1891, Washington, D. C. With mature oöspores in leaves. P. H. Dorsett and W. T. Swingle, No. 4026, October 10, 1891, mouth of Sassafras River, Still Pond, Kent County, Md. With mature oöspores in leaves. The specimens included in this number were collected on many individuals of a smooth-leaved form of *Celtis occidentalis*, which had slender, smooth twigs. The trees grew at the

edge of a wood at the top of the banks of a small stream. W. T. Swingle, No. 4027, October 10, 1891, Still Pond, Kent County, Md. With mature oöspores in leaves. This number includes leaves from two individuals of a rough-leaved, coarse-twigged form of the host, on which the fungus was rare. One individual was a good-sized tree, growing with those from which No. 4026 was collected; the other (No. 4027*a*) was a small sapling growing by the wayside.

42. Peronospora echinospermi Swingle.

1889. *Peronospora Cynoglossi* Burrill, var. (?) *Echinospermi* Swingle. A list of Kansas species of Peronosporaceæ No. 21. <Trans. of 20 and 21st meetings Kans. Acad. Sci. (1887–1888), Vol. XI, pp. 77–78.

Conidia and oöspores on leaves, stems, and fruits of Borraginaceæ.

On *Echinospermum Redowskii* Lehm., var. *cupulatum* Gr. E. Bartholomew, No. 469, June 10, 1891. Rockport, Rooks County, Kans. Conidiophores on leaves, stems, and calyces; oöspores in mesophyll of leaves, bark, parenchyma, and pith of stems and in walls of nutlets.

On *Echinospermum Redowskii* Lehm., var. *occidentale* Wats. F. W. Anderson, No. 10, May 27, 1887, Helena, Lewis and Clarke County, Mont. Conidia only on leaves. E. Bartholomew, No. 470, June 15, 1891, Rockport, Rooks County, Kans. Conidia on leaves, calyces, and stems; oöspores, bark, parenchyma of stems, and walls of nutlets.

Through the kindness of Mr. Bartholomew I have been able to obtain an abundance of mature oöspores of this form, and after a careful study I feel reasonably certain that it is specifically distinct from *P. cynoglossi* Burrill, to which I referred it as a doubtful variety in 1889.* The oöspores occur in great profusion in the cortical parenchyma of the stems, and occasionally beneath the thickened outer layer in the wall of the nutlets, in mesophyll of leaves and calyces and in pith of stems. It is noticeable that they occur only in thin-walled tissue, and of such tissue they seem to prefer the best nourished. The bark and the seeds, which contain nearly all the oöspores, resist decomposition longest after the death of the plant.

The oöspores are unusually large, in fact the largest I have studied, being 35 to 50 by 33 to 47 μ, mostly 38 to 45 by 36 to 42 μ, in diameter. They are rather dark-brown, nearly globose, have a thick (mostly 2 to 7 μ), brown epispore, whose surface is slightly undulating and furnished with curious markings.

These epispore markings consist of very narrow (one-eighth to one-half μ), irregular, interrupted zigzag lines, which occasionally anastomose. The lines do not appear to be raised markings, such as are common on oöspores of *Peronosporaceæ*, but rather lighter colored portions of the epispore wall.

In sections the epispore has a distinctly radiate structure, seeming to be composed of brown, radiating prisms, between which are narrow stripes of lighter-colored substance.

* A list of the Kansas species of Peronosporaceae loc. cit. I wish to correct an error on p. 77 of this list. The host plant of *P. cynoglossi* should be *Cynoglossum Virginicum* L., not *C. officinalis* L., as given.

Possibly the lines seen on the surface are due to this lighter colored substance between the prisms. The endospore is 2 to 3 μ thick and homogeneous. Undoubtedly its composition is quite different from that of the epispore. The sphere bounded by the endospore is very constant in size, being 28 to 38 μ, mostly 29 to 34 μ.

The mycelium is very variable in diameter, and is furnished with abundant haustoria. The haustoria are filiform and almost always unbranched. Near the base they are gradually narrowed till, at the point of union with the mycelium, they are only about half as thick as at the distal end. They are usually very much bent and contorted, often appearing like a tangled mass of filaments. They often attain considerable length, sometimes as much as 40 μ.

As I have already described* the conidiophores and conidia I need not speak of them here, except to mention that in examining conidia that had been treated with warm KHO solution, and thus rendered lifelike in shape, I saw a number that had still attached lateral germ tubes. I have, finally, to report a most remarkable form of the conidial fructification in the Montana specimens collected by F. W. Anderson. The conidiophores are less branched than in the Kansas specimens, and the antepenultimate and penultimate branches are shorter and the ultimate are shorter still. All branches are strongly tinged with fuliginous, while the Kansas specimens show only faint traces of coloration in the conidiophores. The most remarkable character of these specimens is the fact that the conidiophores issue from the stomata in dense groups often comprising 10–15 or even more members. In the Kansas specimen of *P. echinospermi* the conidiophores arise singly or more often in groups of 2–5 through the stomata. For the present, till more specimens can be obtained and, if possible, oöspores be found, I think this form had best be referred doubtfully to *P. echinospermi.*

I have compared *P. echinospermi* very carefully with *P. cynoglossi* Burrill and find besides the differences in the conidiophores and conidia which I pointed out in 1889, considerable differences in the oöspores. The oöspores of *P. cynoglossi* differ from those of *P. echinospermi* in being considerably smaller (25–30 μ diameter sec. Burrill, but in what I have measured 27–40 μ mostly 27–34 μ diameter), in having usually a thinner epispore which does not show the peculiar surface markings, and is indistinctly if at all radiate in structure.

Peronospora myosotidis De Bary, and *P. asperuginis* Schroeter, differ from *P. echinospermi* in the conidial fructification in which they approach more nearly *P. cynoglossi.* If the published descriptions are at all to be relied upon the oöspores of these two species are very different from those of *P. echinospermi.* Unfortunately I have not been able to find any oöspores of either of these species in the specimens at my disposal. I append measurements (all given in μ's) of oöspores of *P.*

*A list of Kansas species of Peronosporaceae, *loc. cit.*, pp. 77–78.

cynoglossi and *P. echinospermi*. Most of the oöspores were measured in actual sections, which were obtained with a microtome, but I also give a number of measurements of *P. echinospermi* in optical section, since it is the usual method of measuring, and therefore gives results more strictly comparable with published measurements of other species. I am, however, convinced that the study of oöspores in actual section offers great advantages over the common method of studying them in optical section.

Table of measurements of ten oöspores of Peronospora cynoglossi, Burrill, *in actual section.**

Diameter of oöspore.	Diameter of oöspores lacking epispore.	Thickness of endospore.	Thickness of epispore.	Diameter of oögonium.
27 by 25	18	1½	2 –4	30 by 28
27 by 26	21	1½	2 –4	32 by 30
30 by 26	24	2	2 –3	44 by 31
30 by 28	22	2	1 –3	32 by 29
30 by 28	24	2	2 –4	36 by 32
30 by 29	24	2	2 –4	36 by 30
32 by 30	27	2	1½–4	44 by 32
33 by 31	26	3	1½–3	38 by 32
34 by 31	27	2	2 –3	40 by 34
40 by 33	28	2	2½–5	40 by 35

* These oöspores were measured from a specimen on *Cynoglossum Virginicum*. (A. B. Seymour, Illinois State Laboratory of Natural History, No. 4703, May 16, 1882, Sanburn, Ill.) They were measured in actual section in water, as indicated in the other tabulations of measurements given. One division of the eye-piece micrometer equalled 2 μ. All measurements given in μ's. I am indebted to Mr. Waite for this specimen, as well as for the permission to use his whole herbarium for comparisons.

Table of measurements of twenty-five oöspores of Peronospora echinospermi, Swingle, *in optical section.*†

Diameter of oöspore.	Diameter of oöspore without epispore.	Thickness of endospore.	Thickness of epispore.	Diameter of oögonium.
*38 by 36	31	2	3½ to 6	54 by 44
39 by 37½	30	1½	3½ to 6	54 by 45
40 by 39	29	2	2 to 6	60 by 46
*40 by 39	33	2½	3 to 5	58 by 50
40½ by 39	31½	1½	4½ to 7½	54 by 54
42 by 40½	31½	1½	3 to 6	55½ by 54
42 by 40½	32½	1½	4½ to 7½	63 by 61
*42 by 41	32	1½	4 to 6	76 by 50
43½ by 37½	31½	2½	4½ to 9	61½ by 48
43½ by 39	30	2½	6 to 7½	67½ by 48
43½ by 40½	30	1½	4½ to 9	63 by 42
43½ by 42	30½	1½	4½ to 6½	63 by 61½
45 by 42	32	1½	4 to 7½	66 by 54
45 by 42	36	1½	6 to 9	69 by 55½
45 by 44	33	2½	4 to 6	54 by 52
*45 by 44	34	2½	4 to 5	60 by 56
*46 by 41	32	3	4 to 5	56 by 50
46 by 44	33	2	4 to 6	56 by 52
*46 by 46	35	2½	4	72 by 50
46½ by 45	35¼	2¼	4½ to 7½	61½ by 52½
48 by 48	38	2½	4 to 5	72 by 54
*50 by 48	40	2½	3 to 5	78 by 60
51 by 40½	30	1½	4½ to 9	57 by 48
51 by 45	36	1½	6 to 11½	63 by 54
57 by 45	35½	2¼	6 to 13½	69 by 60

† These specimens were measured from oöspores teased out of the tissues from the same specimens and in the same manner as indicated in the following table of measurements. One division of the eye-piece micrometer equaled 2 μ. All were from *Echinospermum Redowskii* Lehm. var. *occidentale* Wats. except those marked with an asterisk (*), which were from *E. Redowskii* Lehm. var. cupulatum. Gr. All measurements in μ's.

Table of measurements of fifty oöspores of Peronospora echinospermi Swingle, *in actual section.**

Diameter of oöspore.	Diameter of oöspores without epispore.	Thickness of endospore.	Thickness of epispore.	Diameter of oögonium.
35 by 34	28 by 27	2	2½ to 2¾	40 by 38
36 by 33	32 by 28	2	3 to 4	54 by 40
36 by 34	28 by 27	2½	3 to 4	46 by 38
36 by 35	29 by 29	2½ to 3	2 to 4	44 by 38
36 by 36	28 by 28	2	3 to 6	52 by 44
38 by 33	29 by 27	2½	3 to 4	54 by 40
38 by 36	29 by 29	2½	2¾ to 4	46 by 44
38 by 36	30 by 30	2½ to 3	3 to 5	47 by 22
38 by 37	30⅓ by 30½	2	3 to 4	50 by 40
39 by 34	31 by 27	2½	2½ to 4	48 by 36
39 by 38	30 by 30	2½	2½ to 4	62 by 46
40 by 34	30 by 30	2⅔	3 to 4	46 by 40
*40 by 35	32 by 28	2½	4 to 4½	50 by 42
40 by 36	32 by 26	2	3 to 4	59 by 41
40 by 37	30 by 30	2	4 to 7	46 by 40
40 by 38	32 by 32	2	2¾ to 5	57 by 42
40 by 39	29 by 29	2½	5 to 6	50 by 46
40 by 39	30 by 30	3	4 to 5	68 by 46
40 by 40	29 by 29	2½	4½ to 8	54 by 50
40 by 40	31 by 31	2	4 to 5	48 by 42
40½ by 39	31 by 31	3	4 to 6	54 by 50
41 by 38	30 by 30	2	4 to 6	70 by 40
41 by 40	30 by 30	2½	2¾ to 5	54 by 42
41 by 40	31½ by 28	2	4 to 6	62 by 42
*42 by 34	32 by 25	2	4½ to 4	52 by 38
42 by 38	28⅔ by 28½	2	4 to 6	44 by 42
42 by 38½	29 by 29	2	2½ to 10½	54 by 54
42 by 38½	30 by 28	2	4 to 8	52 by 44
42 by 38½	31 by 30	2 to 2½	4 to 6½	52 by 46
42 by 40	30 by 30	2	3 to 8	50 by 46
42 by 40	30 by 30	2½	4 to 6	46 by 44
*42 by 40	31 by 31	2½	4 to 5	50 by 50
42 by 42	30 by 30	3	4 to 6	58 by 52
43 by 42	30 by 30	2 to 2½	4½ to 5	50 by 48
44 by 40	32 by 32	2½ to 3	4 to 7	54 by 48
44 by 40	34 by 31	2	2⅔ to 4	52 by 46
*44 by 40	34 by 31	2½	4 to 5	62 by 60
*44 by 40	36 by 32	2½	3⅔ to 4	56 by 50
*44 by 41	33 by 32	2½	4 to 4½	54 by 44
*44 by 41	33 by 32	2	4 to 5	50 by 46
44 by 42	32 by 32	2 to 2½	4 to 6	50 by 48
44½ by 40	32 by 32	3	5 to 6	54 by 42
44½ by 42	31½ by 31½	2 to 2½	4½ to 7½	60 by 52
45 by 45	34 by 34	4	4 to 5	64 by 54
46 by 41	31 by 31	2½	4 to 5	52 by 48
46 by 42	31 by 31	2	4½ to 7½	59 by 52
*46 by 42	33 by 31	3	4 to 6	60 by 46
48 by 45	35 by 35	2½	4 to 7	59 by 51
48 by 47	34 by 34	2½	4 to 8	60 by 52
50 by 45	38 by 38	4	4 to 6	64 by 62
Extremes.				
35 to 50 by 33 to 47	28 by 28 to 38 by 38	2 to 4	2½ to 10½	40 to 64 by 22 to 62
Most common sizes.				
38 to 45 by 36 to 42	29 by 29 to 34 by 34	2 to 3	2½ to 7	46 to 60 by 42 to 52

* All the measurements are from actual sections made through the middle portions of the oöspores. The specimens were treated with hot water first, and were afterward studied in water alone. In measuring, Zeiss's 2mm. homog. immers. obj., 6 compen. ocular, etc., were used, and with a tubelength of 159½ mm.: one division of the eyepiece equaled 2μ. These measurements were all made from specimens collected by E. Bartholomew. All were from specimens collected on *Echinospermum Redowskii* Lehm., var. *occidentale* Wats. Collected June 15, 1891, except those marked with an asterisk (*), which were on *E. Redowskii*, var. *cupulatum* Gr., collected June 10, 1891. All measurements given in μ's.

43. Peronospora claytoniæ Farlow. Enumeration of the Peronosporeæ of the United States, No. 11. <Bot. Gaz., vol. VIII, No. 10, October, 1883, p. 314.

On leaves of Portulacaceæ.

On *Claytonia Virginica* L. M. Varney, April 28, 1891, Piney Branch, Rock Creek, D. C.

44. Peronospora rubi. Rabenhorst, Fungi europæi, No. 2676. (1882.)

On leaves of Rosaceæ, tribe Rubeæ.

On *Rubus villosus* Ait. M. B. Waite, No. 270, September 8, 1888, Oregon, Ogle County, Ill. M. B. Waite, No. 271, September 10, 1888, Oregon, Ogle County, Ill. M. B. Waite, No. 279, September 10, 1889, Oregon, Ogle County, Ill. M. B. Waite, No. 560, Oct. 7, 1891, Zoolog. Park, Washington, D. C.

On *Rubus Canadensis* L. P. H. Dorsett and W. T. Swingle, No. 4029, October 29, 1891, Garrett Park, Montgomery County, Md. W. T. Swingle, No. 4030, October 29, 1891, Rockville, Montgomery County, Md. B. T. Galloway and P. H. Dorsett, November 8, 1891, Garrett Park, Montgomery County, Md. In the fall of 1891 many of the individuals of this host showed the bright red spots caused by the parasite.

45. Peronospora sparsa Berkeley. <Gard. Chron. and Agric. Gaz., London, April 5, 1862, pp. 307 and 308 with fig.

On leaves of Rosaceæ, tribe Roseæ.

On *Rosa* sp. cult. D. G. Fairchild, June, 1891, in greenhouse Geneva, Ontario County, N. Y. Mr. Fairchild reports this species as very destructive, completely defoliating the plants. Bordeaux mixture was afterward used with good success in preventing it.

46. Peronospora sordida Berkeley & Broome. Notices of British Fungi, No. 953. <Ann. and Mag. Nat. His., 3d ser., vol. VII, London, June, 1861, p. 449.

On leaves of Scrophulariaceæ.

On *Scrophularia nodosa* L. C. H. Demetrio, June, 1889, Sweet Springs, Saline County, Mo. M. B. Waite, No. 536, August 25, 1888, Urbana, Champaign County, Ill. M. B. Waite, No. 543, September 11, 1888, Rochelle, Ogle County, Ill. M. B. Waite, No. 317, September 14, 1889, Oregon, Ogle County, Ill. M. B. Waite, No. 142, September, 1889, Oregon, Ogle County, Ill.

NEW SPECIES OF FUNGI.

By J. B. Ellis and B. M. Everhart.

Puccinia Suksdorfii, *n. sp.*—On leaves of *Troximon glaucum*. Washington (Suksdorf) and Helena, Mont. (Kelsey). I and II not seen; (III) sori small, black, naked almost from the first, subconfluent, amphigenous, the leaf often marked with a small round purplish spot on the side opposite the sori. Teleutospores short-elliptical, obtuse and broadly rounded at both ends, deep brown, granular-roughened all over as if sprinkled with minute grains of sugar, constricted at the septum; 40–50 × 25–30 μ, on pedicels scarcely longer than the spores.

PUCCINIA AGROPYRI, *n. sp.*—On leaves of *Agropyrum glaucum*. Montana, August, 1890. (F. D. Kelsey). (II) Sori epiphyllous, narrow, oblong or linear, short, cinnamon-yellow, only slightly elevated. Uredospores subglobose, ovoid or elliptical, pale, 20–25 × 18–22 μ; epispore tolerably thick and smooth, pedicels short. (III) Sori hypophyllous, oblong or linear, short, black, covered (almost permanently) by the lead-colored epidermis. Teleutospores cylindric-clavate, 60–75 × 20–25 μ, moderately constricted, pale, squarely truncate, broader and darker but scarcely thickened at the apex, sometimes obliquely truncate or rounded or even obtusely pointed. Pedicels short.

STICTIS COMPRESSA, *n. sp.*—On dead limbs of *Carpinus Americana*. London, Canada, May, 1891. (Dearness, No. 627.) Ascomata scattered or gregarious, immersed, compressed $1\frac{1}{2} \times \frac{1}{3}^{mm}$ sunk in the wood; erumpent above in a small, round, white, minutely perforated, slightly prominent disk. Asci cylindrical, 225–260 × 10 μ, with abundant filiform paraphyses. Sporidia filiform, 220–240 × $1\frac{1}{2}$ μ, nucleate. Differs from the ordinary type in its minute disk with only a small central perforation.

TRYBLIDIELLA PYGMÆA, *n. sp.*—On weather-beaten wood, Ohio. (Morgan, No. 961). Perithecia acutely-elliptical, erumpent, not polished, black, $\frac{3}{4}$–1^{mm} long, lips loosely closed when dry. Asci oblong, 65–80 × 15 μ including the short, abrupt stipe, paraphysate, 4-8 spored. Sporidia subbiseriate, fusoid-oblong, 3-septate, pale brown (hyaline at first), 16–20 × 6–7 μ, ends subobtuse.

VALSARIA HYPOXYLOIDES, *n. sp.*—On bark of some tree or shrub, Central Paraguay, South America. (Morong, No. 1431. Communicated by Dr. J. W. Eckfeldt.) Stromata erumpent, superficial, subcarnose, subseriate, subglobose, $\frac{1}{2}^{mm}$ in diameter, narrowed at base, purplish rust-color, appearing almost exactly like *Hypoxylon fuscum* (Pers), in color and shape. Perithecia peripherical, ovate, small, less than $\frac{1}{4}^{mm}$ high, seated on the ovate, cinereous-gray core of the stroma, and barely covered by the thin outer layer. Ostiola subdiscoid or convex, umbilicate, black. Asci cylindrical, 90–115 × 12 μ, subsessile, paraphysate, 8-spored. Sporidia uniseriate, oblong-elliptical, 1-septate, dark brown, scarcely constricted, 12–15 × 7–9 μ. When the colored subferruginous coat is rubbed off the stroma is nearly black. Differs from *Hypoxylon* only in its soft stroma and uniseptate sporidia.

PHYLLOSTICTA GELSEMII, *n. sp.*—On leaves of *Gelsemium sempervirens* (cult.) Newfield, N. J., April, 1891. Spots suborbicular, 2–4^{mm} in diameter, or often occupying the apex of the leaf, pale yellow-brown with a purple border. Perithecia amphigenous, sublenticular, black, small, gregarious, shining, rather more abundant above. Sporules oblong-cylindrical, 12-16 × 3 μ.

PHYLLOSTICTA RHODODENDRI, *West.*—On leaves of *Rhododendron Catawbiense*. Newfield, N. J., April 20, 1891. Spots large; 1-3^{cm}, mostly marginal, dark reddish-brown, concentrically zoned, definitely

limited, the living part of the leaf bordering the spots narrowly shaded with yellow. Perithecia innate, sunk in the parenchyma of the leaf, the dark apex barely visible and only very slightly prominent, epiphyllous, about 150 μ in diameter. Sporules narrowly and acutely elliptical, hyaline, continuous, often binucleate, 15–20 × 6–7 μ.

SPHÆROPSIS ALBESCENS, *n. sp.*—On dead limbs of *Negundo aceroides*. Brookings, S. Dak., September, 1891. (T. A. Williams.) Perithecia gregarious, globose, $\frac{1}{2}^{mm}$ in diameter, buried in the bark, but raising the epidermis into little pustules which are barely pierced by the papilliform ostiolum. Sporules oblong-elliptical, brown, continuous, obtuse, 15–20 × 8–10 μ. The perithecia are mostly found around the nodes of the smaller limbs, extending for a centimeter or more on each side of a bud, and the epidermis over these areas becomes whitened out.

STAGONOSPORA SPINACIÆ, *n. sp.*—On spinach, Brookings, S. Dak., July, 1891. (T. A. Williams.) Spots amphigenous, round, dirty white, 3–5^{mm} in diameter, without any very distinct border. Perithecia epiphyllous, erumpent, rough, black, subhemispherical, 75–100 μ in diameter, with a papilliform ostiolum. Sporules oblong-cylindrical, obtuse, often slightly curved, hyaline, 1–3 septate, 15–30 × 8–10 μ.

SEPTORIA ELYMI, *n. sp.*—On leaves of *Elymus Canadensis*. London, Canada, July, 1891. (Dearness, No. 808.) Perithecia subglobose, 100–120 μ in diameter, epiphyllous, mostly on narrow, dirty white spots 3–4^{mm} long by $\frac{1}{2}^{mm}$ wide, visible as black specks. Sporules clavate-cylindrical, bent or curved, continuous, faintly nucleate, 15–25 × 1½–2 μ. Differs from *S. bromi* Sacc., in its shorter sporules and narrow, elongated spots.

SEPTORIA JACKMANI, *n. sp.*—On leaves of *Clematis Jackmani* in a hothouse, Geneva, N. Y., August, 1891. (D. G. Fairchild.) Amphigenous. Perithecia large, conic-hemispherical, black, broadly perforated above, semi-immersed, the upper half projecting; gregarious on yellowish, indefinite spots. Sporules, clavate-filiform, 40–70 × 2½–3 μ nucleate, but not visibly septate, thicker above, subattenuated below, only moderately curved. This is quite different from *S. Clematidis*, Rab., which is on definite, brown spots, and has smaller perithecia and smaller sporules. It is much nearer *S. expansa*, Niessl., but, besides the different host plant, that species is hypophyllous and has narrower (1½–2 μ) sporules. Saccardo in *Sylloge* gives the sporules as only 1 μ thick, but in the specimen in Rabenhorst-Winter Fungi Europæi, 2897, the sporules are, as just stated, 1½–2 μ thick.

SEPTORIA SACCHARINA, *n. sp.* —On living leaves of seedling maples (*Acer saccharinum*), Niagara, Canada, August, 1891. (Dearness, No. 1812.) Spots amphigenous, scattered, small, definite, white, more obscure below, 1^{mm} in diameter. Perithecia few (½ on a spot), epiphyllous, lenticular, brown, 200 μ diameter. Sporules clavate-cylindrical, nucleate, hyaline, 40–50 × 1½–2 μ. Distinguished from the other acericolous Septorias by the small, white spots.

SEPTORIA DRUMMONDII, *n. sp.*—On leaves of *Phlox Drummondii*. London, Canada, September, 1891. (Dearness, No. 820.) Differs from *S. divaricata* E. & E. on *Phlox divaricata* (this JOURNAL, Vol. v, p. 151) in the perithecia being scattered thickly over the entire surface of the leaf, and not on any definite spots. Perithecia black, subprominent, 100 μ in diameter. Sporules nearly straight, nucleate, 35–50 × 1½–2 μ, rather narrower at one end.

HENDERSONIA GEOGRAPHICA, *n. sp.*—On fallen and decaying chestnut leaves. Newfield, N. J., April 4, 1891. Acervuli gregarious, on pale spots, dark brown, flattish, ¼–⅓ mm in diameter, mostly on the nerves of the leaf, and forming a kind of network, reminding one of *Asteroma geographica*, Fr. Sporules oblong-fusoid, pale brown, 3-septate, the terminal cells hyaline, acutely conical and 4–5 μ long, the colored part 10–12 × 3–3½ μ. Pedicels filiform, about 15 μ long, sometimes remaining attached to the sporule. Terminal cell prolonged into a short, subulate beak, or oftener simply narrowed into a subulate point. The terminal cells are finally deciduous. Differs from *P. nervalis*, E. & E. (to which it bears a strong resemblance) in its smaller, 3-septate sporules and larger acervuli.

GLŒOSPORIUM CATALPÆ, *n. sp.*—On living leaves of *Catalpa bignonioides*. Wilmington, Del., August, 1891. (Commons, No. 1804.) Spots orbicular, 2–3 mm in diameter; definite, reddish-brown, paler in the center. Acervuli minute. Spores oblong, hyaline, continuous, 2-nucleate, 10–15 × 3–5 μ, erumpent on the upper side of the leaf in small, yellowish heaps.

GLŒOSPORIUM DECOLORANS, *n. sp.*—On leaves of *Acer rubrum*. London, Canada, August, 1891. (J. Dearness, No. 813.) Occupying the areas between the main veins of the leaf, and causing large brown spots which occupy the entire surface of the leaf except a narrow strip along each side of the midrib and its main branches. Acervuli numerous, small, erumpent on the lower side of the leaf. Spores oblong-elliptical, hyaline, 5–8 × 2½–3 μ. Very destructive to the leaves.

MELANCONIUM MAGNOLIÆ, *n. sp.*—On dead trunks of *Magnolia glauca*. Newfield, N. J., June, 1891. Acervuli sunk in the bark, ovate-conical, 1–1½ mm in diameter, substratum pale. Conidia obovate, pale olive brown, with a hyaline margin and a large nucleus, 12–15 × 9–11 μ on stout (4 μ thick), simple or branching, obscurely septate basidia, 50–75 μ long, erumpent in masses or black cirrhi, like coarse, black hairs or black wool.

PESTALOZZIA LATERIPES, *n. sp.*—On dead legumes of *Cassia Chamæcrista*. Newfield, N. J., September and October, 1891. Perithecia pustuliform or subhysteriiform, about ¼ mm in diameter, with a large, irregular opening above, sometimes with an elongated slit, as in *Hysterium*. Sporules clavate-cylindrical, yellowish brown, 3-septate, the upper cell rounded above with a hyaline, subconical tip bearing at its apex a 3-parted crest of three, spreading slender bristles 15–20 μ long, the lower

cell narrower and furnished with an eccentric pedicel 10–12 μ long, reminding one of a *Discosia*.

SCOLECOTRICHUM CARICÆ, *n. sp.*—On living leaves of *Carica papaya*. Lake Worth, Fla., March. 1891. (L. M. Underwood.) Maculicolous. Spots scattered, 1–2^{mm} in diameter, yellow above, becoming white in the center, suborbicular and definitely limited; completely covered below with densely crowded, minute, sphæriæform, black-brown tufts of the fungus. Basidia oblong or subclavate, continuous, 20–22 × 6–7 μ, forming a compact peripherical layer on a minute tuberculiform base and bearing at their tips the ovate, uniseptate, pale brown, 12–20 × 8–10 μ, conidia.

MACROSPORIUM TABACINUM, *n. sp.*—On leaves of cultivated tobacco (*Nicotiana tabacum*), Raleigh, N. C., October, 1891. (Gerald McCarthy). Spots amphigenous, numerous, thin, white (rusty red or brown at first), suborbicular or irregular, 2–3^{mm} in diameter, definitely limited, with a narrow darker border. Fertile hyphæ effused, 35–45 × 3–4 μ, septate and torulose above. Conidia obovate, 15–25 × 10–12 μ, sessile, or longer (35–45 μ), narrowed below into a distinct stipe, 8–12 μ long. The shorter conidia are mostly 3-septate and the longer ones about 5-septate, one or two of the cells with a longitudinal septum. This is the "white speck" of the North Carolina planters.

MACROSPORIUM LONGIPES, *n. sp.*—On leaves of *Nicotiana tabacum*. Raleigh, N. C., October, 1891. (Gerald McCarthy.) Spots amphigenous, orbicular, rusty brown, 3-5 ^{mm} in diameter; orbicular, zonate. The entire leaf becomes brown and then the spots are a shade lighter than the surrounding parts. Fertile hyphæ effused on the spots, amphigenous, but more abundant above, slender (40–70 × 3–4 μ, septate and often constricted at the septa; erect, more or less torulose above. Conidia clavate, 40–50 × 15–20 μ, 3–7, mostly 5–6 septate, with two or more of the cells divided by a longitudinal septum, attenuated below into a distinct stipe 35–50 μ long, and often septate and torulose. This differs from *M. commune*, Rabh., in its effused hyphæ and smooth conidia, and from *M. tabacinum*, E. & E., in its brown, concentrically zoned spots and larger stipitate conidia. Known among the planters as "brown spot."

BRACHYSPORIUM CANADENSE, *n. sp.*—Parasitic on *Valsa ambiens?* On bark of dead maple limbs. Ottawa, Canada, October, 1890. (Macoun No. 49.) Hyphæ simple, brown; septate, 200–300 × 5 μ, forming dense, tobacco-brown, tuberculiform tufts, rising from the pustules of the *Valsa*. Conidia terminal, solitary, obovate-elliptical, pale brown, 1–3 septate, 20–40 × 12–15 μ.

CLASTEROSPORIUM POPULI, *n. sp.*—On dead places in living leaves of *Populus tremuloides*. London, Canada, June, 1891. (Dearness, No. 759.) On leaves of *Populus grandidentata*. Wilmington. Del. (Commons, No. 1806.) Conidia clavate, 1–2 septate, olive brown, 18–25 × 7–9 μ, mostly a little constricted at the septa, and subtruncate-apiculate at the apex; pedicles very short, almost none, subhyaline. The conidia arise directly

from the cells of the leaf without any well-defined mycelium, and form a continuous olive brown or green stratum on the lower surface of the leaf, beginning with well-defined brown spots which soon spread and occupy the entire leaf—mostly the young terminal ones.

REVIEWS OF RECENT LITERATURE.

FARLOW, W. G., and SEYMOUR, A. B.—*A Provisional Host-index of the Fungi of the United States.* Part I, Polypetalae, pp. 1–52, Cambridge, 1888. Part II, Gamopetalae-Apetalae, pp. 53–134, Cambridge, September, 1890. Part III, pp. 135–220, Cambridge, June, 1891.

The issue of the third part of the above work, containing the endogens, cryptogams, and animals, and an addenda, together with an index to all three parts, finishes this most valuable and laborious work. As completed it contains 220 octavo pages. About 85 names on an average, including synonyms, are given on each page. The work will be a necessity to every American mycologist, and, aside from its direct value as a host-index, will be of very considerable worth as a guide to the synonomy of the American species of fungi. In accuracy and completeness it is almost without equal among mycological publications. It is to be wished, however, that a reference could have been given after each name of a fungus to one or more works in which it was reported on the host in question. It is likely that descriptions of some of the species will be troublesome to find. A title page for all three parts would also be a valuable addition.

Some interesting facts are revealed by a study of the index. The number of species reported on some genera of trees is truly astonishing. The family Cupuliferæ requires 24 pages, and these will probably average no less than 100 names of fungi to a page. A most striking fact is the very small number of species reported on Algæ. Only two species, both *Chytridii*, are given. These occur on four species of Algæ. In Europe, on the contrary, where the algal parasites have been carefully studied, their number is very considerable, probably aggregating several hundred species.

Botanists everywhere would no doubt be very grateful if the authors of the "Host-index" could be induced to prepare the converse work, namely, a list of the species of fungi of the United States with their host plants.—W. T. SWINGLE.

FISCHER, DR. ALFRED.—*Phycomycetes.* Rabenhorst's Kryptogamenflora. I Band. IV Abtheilung: Pilze; 45, 46 and 47 Lieferungen, pp. 1–192. Leipzig. Ed. Kummer, 1892.

Part. IV of this important work begins with No. 45. Part III on Discomycetes by Dr. Rehm still lacks eight numbers of completion, but

the whole of Dr. Fischer's manuscript being in hand, the publisher has wisely concluded to begin publication at once. The lamented DeBary was to have written this volume, and it is a matter for congratulation that his mantle has fallen upon a competent successor.

In Winter's system (Pilze I, p. 32) the Phycomycetes are divided into two classes, Zygomycetes and Oömycetes. The position of the Chytridiaceæ remains doubtful and the Entomophthoreæ, now known to belong to Zygomycetes, are classed under Basidiomycetes. Since the appearance of this first volume so much new light has been thrown on the relationships of fungi that no excuse is necessary for departure from the old views, but some of the changes, *e. g.*, those under Peronosporinæ, will undoubtedly lead to criticism.

The name Phycomycetes, *i. e.*, alga-fungi, indicates the many-sided relationships of the group with certain algæ, *e. g.*, Siphoneæ (Vaucheria, etc.), not only in the possession of a nonseptate vegetative body, sexual organs, and swarm spores, but also in the aquatic life of many sorts. The nonseptate character of the mycelium is especially constant, so that the name Siphomyces, *i. e.*, tube fungi, might properly be used for the whole group, corresponding to the term Siphophyces applied to the parallel group of algæ. Cohn united under the name Siphomycetes the three orders Peronosporeæ, Saprolegnieæ, and Chytridiaceæ and set up the Zygomycetes (Mucorineæ, etc.) as a group parallel to the Zygophyceæ (Conjugateæ). In Cohn's system the Phycomycetes were therefore split into two groups, Zygomycetes and Siphomycetes. Sorokin uses the term Siphomycetes as synonymous with Phycomycetes, in the sense already explained, and although the author thinks Siphomycetes a better name for the group than Phycomycetes he considerately refrains from disturbing the well-established usage. However, it is not simply a question of names, but one of widely differing views as to relationships. De Bary in his Comparative Morphology and Biology puts Peronosporeæ (Ancylisteæ and Monoblepharis included), Saprolegnieæ, Mucorineæ, and Entomophthoreæ at the beginning of his great Ascomycetous series; but he treats the Chytridiaceæ as a group of doubtful position in the system, although recognizing their dependence on these Phycomycetes. Indeed, the disposition of the Chytridiaceæ is the weak point in all previous classifications. So far, all mycologists agree that Peronosporeæ, Saprolegneæ, Mucorineæ, and Entomophthoreæ are genuine Phycomycetes, but some do not regard the Chytridiaceæ as a natural group, *e. g.*, Zopf would separate the Synchitreæ from the Eu-mycetes on account of their plasmodial vegetative body, and would consider them as a special group related to Myxomycetes. In Saccardo's Sylloge (Vol. VII), the Chytridiaceæ are indeed included within the customary limits of the Phycomycetes, but are looked upon as degenerated forms. Brefeld in Heft viii regards the Chytridiaceæ as degenerate Phycomycetes in which the vegetative body is reduced more and more until it disappears entirely in the for-

mation of a sporangium. Thus, according to Brefeld and others, Olpidium represents the final member in a degeneration which began with Peronosporaceæ. The author's view is just the opposite of this. He regards Chytridiaceæ as a natural group and the simplest and earliest in point of time, *i. e.*, as the starting point of the whole great series which ends in the Oömycetes with richly branched mycelium.

Concerning disputed relationships he has the following: The Olpidiaceæ have much in common with the zoösporous Monadineæ, but the differences are still greater. One principal difference consists in the manner of taking food. In the Monadineæ this takes place through the active amœboid movements of the plasmodium by which solid substances are commonly taken up. In the Myxochytridineæ the amœboid movements of the naked vegetative body are always feeble or wholly wanting, and the taking up of solid bodies does not occur. Consequently while the Monadineæ take their food like the Myxomycetes, in the Myxochytridineæ there is only an absorption of dissolved food as in the genuine fungi. In connection with this stands the extrusion of undigested food balls, something which, of course, does not occur in the Myxochytridineæ. Together with the accompanying physiological differences due to the different manner of taking food, there are also important purely morphological differences. In a number of zoösporous Monadineæ (Aphelidium, Plasmodiophora) the amœboid body breaks up into spores without previous formation of membrane, but in those forms in which a wall is previously formed the swarm spores escape from the cyst at indefinite places, *i. e.*, there is no special canal for escape. The contrary is true for all the Myxochytridineæ except Sphærita. Finally it should be emphasized that not rarely the actively amœboid body becomes a genuine plasmodium, through the blending of several amœbæ, while genuine plasmodia are wanting in Myxochytridineæ, with the possible exception of Rozella. The relationship of the Myxochytridineæ with the Monadineæ is to be recognized, but on the other side there is also to be noted in the described departure a step toward the fungi. It is especially the Holochytriaceæ which show a transition into genuine mycelium. Forms like Myzocytium belong with the Myxochytridineæ on account of their holocarpal development, but differ in the elongated vegetative body, surrounded from the first by a membrane, which, by its branching, takes on a mycelial character.

Morphologically the Zygomycetes and Oömycetes can be very easily united to these Holochytriaceæ, as a further development, with a richly branched, eu-carpal, mycelial vegetative body.

The family of the Sporochytriaceæ with mycelial haustoria appears to me to join on to the Hyphochytriaceæ above. Among the Monadineæ, *Colpodella pugnax* shows a similar development but is distinguished by the absence of mycelium and the much later following wall formation. Finally the family of Hyphochytriaceæ which joins on to the Sporochytriaceæ (Polyphagus) is continued into Protomyces and the Ustilagineæ.

Under Phycomycetes the author includes all plants having the following characteristics:

Vegetative bodies one-celled, only forming septa during the production of reproductive organs, or when still older, sometimes unbranched and changing wholly into a sporangium (holocarpal), sometimes a richly branched mycelium with special reproductive organs (eu-carpal). Nonsexual reproduction by swarm spores or non-motile spores; sexual by zoöspores or oöspores.

The following is Dr. Fischer's classification:

PHYCOMYCETES (Siphomycetes).

I. Series. Archimycetes (Chytridiaceæ).
II. Series. Zygomycetes.
III. Series. Oomycetes.

Under the first series he gives the following subdivisions and family characters.

1. Order. Myxochytridineæ.

1. Family. Monolpidiaceæ (Olpidiaceæ).

The entire vegetative body changing holocarpally into a single spherical or elongated zoösporangium or one resting spore. Sexuality observed in one case.

2. Family. Merolpidiaceæ (Synchytriaceæ).

The entire vegetative body splits up holocarpally into a number of sporangia and produces a roundish or long one-rowed sporangial sorus. Resting state either a heap of resting spores, cystosori, or single resting spores, which arise from the entire undivided vegetative body or single parts of it.

2. Order. Mycochytridinæ.

1. Family. Holochytriaceæ (Ancylistaceæ).

Vegetable body tubeform or vermiform, unbranched or with short side branches, dividing by cross septa into a number of members, all of which change into reproductive organs (sporangia, oögonia, antheridia). Strictly holocarpal and monophagous, always intramatrical.

2. Family. Sporochytriaceæ (Rhizidiaceæ, Polyphagaceæ).

Vegetative body consisting of two parts, a spherical strong growing swarm spore, and a tenuous, thread-form, often very delicate, mycelial part. The ball-shaped part grows into a single sporangium, or into a single resting spore. Resting spores also develop in another manner from the mycelial part, or by the copulation of two plants. The mycelial part always perishes after one fructification, *i. e.*, it is strictly monocarpal, but also eu-carpal. There are two subfamilies, Metasporeæ, and Orthosporeæ.

3. Family. Hyphochytriaceæ (Cladochytriaceæ).

Vegetative body, a more or less branched and originally one-celled mycelium, which forms simultaneously a great number of terminal and intercalary swellings, and out of those zoösporangia or resting spores; eu-carpal, but mostly monocarpal; not perennial. Sexuality wanting.

Under the second series he gives:

1. Order. Mucorinæ.

1. Suborder. Sporangiophoræ.

1. Family. Mucoraceæ.

The cross wall which separates the stalk from the sporangium arches into the latter and projects as a columella, often far out. Zygospores naked, or only enveloped by a loose mycelial tissue, never inclosed in a compact receptacle and forming a fruit body. Three subfamilies, Mucoreæ, Thamnidieæ, and Piloboleæ.

2. Family. Mortierellaceæ.

Sporangium without a columella, with gelatinizing membrane. Zygospores single and completely inclosed in a receptacle (carposporium) like a small tuber.

2. Suborder. Conidiophoræ.

1. Family. Chætocladiaceæ.

Conidia single, spherical, in groups on the middle swollen part of the last branches of the conidiophore, the ends of the same remaining tenuous and sterile. Zygospores naked between the straight gametes.

2. Family. Cephalidaceæ.

Conidia in chains on the spherical-headed, swollen branch ends (sterigmata) of the unbranched conidiophore. Zygospores naked on the crown of the tongs-like gametes.

2. Order. Entomophthorinæ.

1. Family. Entomophthoraceæ.

With the characters of the order, *i. e.*, Mycelium mostly parasitic in living animals, rarely in plants, or saprophytic, richly branched, often falling into pieces, at first one-celled. Nonsexual reproduction by conidia which are delimited on the end of unbranched threads growing out of the substratum and thrown off when ripe, *i. e.*, no special conidiophores. Zygospores on the mycelium.

Under the third series he gives:

1. Order. Saprolegninæ.

1. Family. Saprolegniaceæ.

Antheridia applied to the oögonium like accessory branches, pushing fertilization tubes into the latter.

2. Family. Monoblepharidaceæ.

Antheridia with spermatozoids.

2. Order. Peronosporinæ.

1. Family. Peronosporaceæ.

With the characters of the order, *i. e.*, mycelium parasitic in the interior of living plants, richly branched, polycarpal. Nonsexual reproduction by swarm spores or conidia, mostly with specially formed conidiophores breaking out of the substratum. Oögonia always one-celled, with a remnant of unused protoplasm (periplasma). Antheridia applied to the oögonium like an accessory branch, with penetration tube.

1. Subfamily. Planoblastæ (Cystopodeæ).

Nonsexual reproduction by swarm spores. Sporangia, either persistent on mycelium or mostly falling as conidia and producing zoöspores in germination.

2. Subfamily. Siphoblastæ (Peronosporeæ).

Nonsexual reproduction by conidia, which germinate by germ tubes and are homologous to the falling zoösporangia of the Planoblastæ.

Under Archimycetes some general account is given of the group, including directions for collection and preparation of specimens. This is followed by a very convenient and useful key to the genera, 29 in all. The following genera and doubtful genera, including 144 good species and 39 doubtful ones, are described in these three numbers: Sphærita, Olpidium, Pseudolpidium (nov. gen. with figs.), Olpidiopsis, Pleotrachelus, Ectrogella, Pleolpidium (nov. gen. with figs.), Synchitrium, Woronina, Rhizomyxa, Rozella, Micromyces, Myzocytium, Achlyogeton, Lagenidium, Ancylistes, Resticularia, Rhizophidium, Rhyzidium, Rhizidiomyces, Achlyella, Septocarpus, Harpochytrium, Entophlyctis (nov. gen. with figs.), Rhizophlyctis (nov. gen. with figs.), Obelidium Chytridium, Polyphagus, Cladochytrium, Amœbochytrium, Catenaria, Hyphochytrium, Nephromyces, Aphanistis, Saccopodium, Zygochytrium, and Tetrachytrium. Only one new species is recorded, Olpidiopsis minor. The genera are illustrated by good figures and followed by a host index.

The treatment of the Zygomycetes is substantially the same as for the preceding series: first, fourteen pages outlining the main features of the order Mucorinæ, then a key to the genera, followed by a description of the species of the genus Mucor as far as the end of the first section, Mono-Mucor.

This volume, while devoted to the forms occurring in Germany, Austria, and Switzerland, can not fail to be of great service to American students, since many of the described species occur in this country. Reference to doubtful forms and extra-European ones also help to make the book indispensible.—ERWIN F. SMITH.

Fruit culture in foreign countries.—Reports from the consuls of the United States on fruit culture in their several districts in answer to a circular from the Department of State. Washington, Government Printing Office, 1890, pp. 391–937; Index, i–xiii.

This report is devoted principally to the citrous fruits, the olive, fig, and vine. Incidentally there are many references to the diseases of these plants, parasitic and nonparasitic. Some of the statements need to be taken *cum grano salis* because emanating from men not specially trained to observations of this kind, but on the whole the reports appear to be well written and will prove useful. A similar volume on the stone fruits of the world would be equally valuable.—ERWIN F. SMITH.

MANGIN, LOUIS.—(1) *Sur la callose, nouvelle substance fondamentale existant dans la membrane.* Comptes Rendus, Paris, tome CX, 24 Mars, 1890, p. 644.

(2) *Sur les réactifs colorants des substances fondamentales de la membrane.* Comptes Rendus, Paris, tome CXI, 15 Juillet, 1890, p. 120.

(3) *Sur la structure des Péronosporées.* Comptes Rendus, Paris, 15 Décembre, 1890, p. 923.

(4) *Sur la désarticulation des conidies chez les Péronosporées.* Bull. de la Soc. Bot. de France. Comptes Rendus des Séances, Paris, 1891, tome 38, pp. 176–184, 232–236, pl. 4.

(1) The author distinguishes three fundamental substances in the cell walls of plants—pectin compounds, cellulose, and callose. The latter has been studied quite carefully, and is described as a new fundamental substance, known hitherto only from sieve tubes. Not having been able to isolate it in sufficient purity for a chemical analysis, the author confines himself to an account of its distribution in plants.

Callose is colorless and amorphous, insoluble in water, alcohol, and Schweizer's reagent,* even after the action of acids; very soluble in soda or cold caustic potash 1 to 100, soluble cold in sulphuric acid, chloride of calcium, and concentrated bichloride of tin; insoluble cold in the alkaline carbonates, and in ammonia, which swells it and gives it a gelatinous consistency. Besides aniline blue and rosolic acid†

*Cuprammonia. †Known also as corallin, aurin, peonin.

already recommended by Russow and Janczewski for the study of liber, the color reagents of callose are certain substances of the series of azo colors, belonging to the group of benzidines, tolidenes, etc. Iodated reagents give to callose a yellow tint. Callose is therefore as distinct as cellulose or the pectin compounds. It is not a result of the artificial decomposition of the latter substances, for these may be treated in all sorts of ways without producing the reactions of callose. Its insolubility in the cuprammoniacal reagent, even after the action of acids, and the yellow color which it gives with iodated phosphoric acid distinguish it from cellulose, while its insolubility in cold ammonia and alkaline carbonates, and its inertia toward stains which act on the pectin compounds separate it not less clearly from the latter.

While callose exists normally in certain regions of the reproductive organs of phanærogams (pollen grains, pollen tubes, etc.) and vascular cryptograms, it is not found in the vegetative portions of these plants, exclusive of the liber, save accidentally and as irregular masses scattered through the cells. But in the thallophytes callose acquires a great importance. In the fungi it forms the membrane of the mycelium and of the organs of fructification in the most widely separated families; *e. g.*, Peronosporeæ, Saprolegniaceæ, Basidiomycetes, Ascomycetes, Saccharomycetes. In lichens callose exists in the mycelial filaments, but not in the gonidia. It does occur, however, in some of the algæ. On the other hand, he has not yet found it in certain Uredineæ, nor in the mycelium and conidiophores of the Mucorinæ. In the plants of this order Mucor, Phycomycetes, Rhizopus, Pilobolus, Chætocladium, etc., it constitutes only the dissolving wall of the sporangium, and some part of the membrane of the spores. Callose appears to be in a state of purity in the membrane of the sporangium of the Mucorinæ, but in the mycelium of the Peronosporinæ and Saprolegninæ it is intimately united with cellulose, to the exclusion of pectin compounds, and, finally, in the Polyporei (Dædalea), the mycelial tubes appear to be destitute of cellulose, and are formed of callose associated with substances having the reaction of pectin compounds.

Various circumstances often mask the presence of callose, such as physical differences or the incrustation of foreign substances, for example, the callose of pollen mother cells and that which forms irregular masses in the mycelium and haustoria of the Peronosporinæ presents the most alterable and easily distinguishable state. In the sporangium of the Mucorinæ and the mycelium of lichens the callose offers more resistance to the action of solvents and fixes stains less readily. Finally, in the Polyporei it coheres so strongly that its presence can be demonstrated only after long and repeated treatments.

(2) The various stains of the aromatic series may be divided into two groups, one consisting of basic colors united with various mineral or organic acids, the other of acid colors used in the form of alkaline salts. Substances of the first category are fixed with a variable energy

by pectin compounds, which thus reveal their acid function. They do not stain callose or cellulose. The following compounds are noteworthy: *Azo group* Vesuvin brown, chrysoidin; *diphenyl-methane group*, auramine; *triphenylmethane group*, the Victoria blues, bleu de nuit, fuchsine, Paris violet, Hofman's violet, etc., all the stains of the *oxazine group*, naphthaline blue, Nile blue; *thionine group*, methyl blue; *euhrodine group*, neutral red; *safranine group*, neutral blue, pheno-safranine extra safranine, rosaline, Magdala red. The affinity of these substances for pectin compounds is very dissimilar. It is also feeble, for the presence of an excess of acid or of glycerine removes the stain from the tissues more or less readily.

The second category, formed of alkaline salts, contains a great number of substances which never stain pectin compounds. Many, however, are fixed by cellulose and callose, and thus show the basic nature of these latter, a nature already known and used for a long time, so far as concerns cellulose. In this category only two groups are of interest, the *azo group* and the *triphenylmethane group*. The azo group, exclusive of chrysoïdine and Vesuvin brown, is composed principally of alkaline salts. In this group we distinguish three important types. The first includes the various stains which contain the azo grouping once, *e. g.*, xylidine ponceau, aniline ponceau, toluidine ponceau, naphthorubin, etc., as well as various tropeolines of a slightly different composition. These substances stain protoplasm yellow, but they have no action on cellulose and callose. The second type is formed of substances containing the azo grouping twice, *e. g.*, orseille red, orseilline BB, azorubine, naphthol black, the croceines, etc. These substances stain cellulose in a neutral or slightly acid bath, but have no effect on callose. The third type contains the stains of the benzidine series, *e. g.* Congo red, Congo GR, Congo brilliant G, Corinthian Congo, extra Bordeaux, delta purpurine G, which result from the action of sulphonated naphthol compounds upon benzidine; azo blue, Corinthian Congo B, the benzo purpurines and the rosazurines, in which toluidine is substituted for benzidine; azo violet, the benzo azurines and heliotrope, where dianisidine is substituted for benzidine. These colors, ordinarily precipitated by acids, stain cellulose directly in a neutral or, better, a slightly alkaline bath.

The triphenylmethane group does not offer as distinct relations between staining capacity and chemical composition. We first distinguish a large number of bodies formed by chlorhydrates, sulphates, etc., which stain pectin compounds directly. Then a series of alkaline salts which may be divided into three groups. The first group includes acid fuchsine, acid violet, Bayer's blue, the alkaline blues, etc., which result from the respective action of sulphuric acid on fuchsine, Paris violet 6B, diphenylamine blue, and analine blue. These substances do not stain cellulose, but certain of them stain callose, *e. g.*, the soluble blues, and notably Bayer's blues. The staining is energetic

in proportion to the completeness of the sulphonization, *e. g.*, the blue 6B, a mixture in which trisulphonated triphenylrosanilin predominates, is the most active of the soluble blues. The second group is formed by the alkaline salts of rosolic acid, which stain callose and cellulose directly. Finally, the third group, the eosines, or salts or fluorescine such as eosine, erythrosine, and phloxine, stain nitrogenous matters deeply, but are not fixed by callose or cellulose.

As various stains of the aromatic series also combine with nitrogenous substances, to avoid error it is often indispensable that there should be a mixture of several reagents belonging to different categories. This gives a very demonstrative double stain.

(3) The constitution of the membrane of fungi is still unknown. The author believes that fungine and metacellulose do not exist as specifically distinct substances. The membrane of fungi is so complex and variable that it would be possible to offer the chemical composition in evidence whenever the absence of fructification rendered the determination of families uncertain.

In the group under consideration the membrane is composed of callose and cellulose closely associated. To show this, leaves containing *Peronospora ficariæ* may be treated as follows:

(*a*) Treat with concentrated chlorhydric acid; (*b*) macerate for some minutes in Schweizer's reagent. This removes all the cellulose and pectin compounds contained in the host and in the parasite. After washing in water, the use of iodated phosphoric acid or of the benzidine colors does not reveal a trace of cellulose in the tissue of the leaf, but the reagents of callose bring out a network of mycelial filaments. Contrarywise, if we submit the contaminated leaves of the Ranunculus to the action of Hofmeisters's chlorated mixture* and after washing allow the tissues to macerate in a solution of potassa or caustic soda, renewed several times, all the callose is removed without sensible modification of the cellulose. Then by the use of iodated reagents we can see the mycelial filaments stained blue or violet in the midst of the disassociated tissues of the host plant.

Thus either the cellulose or the callose can be removed without changing the form and arrangement of the mycelium. But while cellulose and callose are always associated in the organs which the parasite sends into the host (mycelium and oöspores), the conidiophores are formed of pure cellulose. This is proved by their disappearance after the action of cellulose solvents.

The mycelial membrane varies in thickness and shows numerous layers, but what gives the mycelium of the Peronosporinæ a special character is the constant presence of masses of callose, which is either pure or associated with cellulose. These constrict the cavity of the tube or even obliterate it. In the latter case, they form the so-called septa. These masses are seen very clearly in *Peronospora parasitica*, *P. Schleideni*, *P. myosotidis*, *Plasmopara viticola*, etc. They serve very clearly

to distinguish the Peronosporinæ from other parasites. Pollen tubes inside of tissues are the only bodies likely to be confounded with them, and this only in case of species with much reduced haustoria.

The haustoria have the same structure as the mycelium and their shape and varying size always furnish excellent data for distinction of species. They are sometimes so minute as to have thus far escaped the attention of botanists, *e. g.*, *Phytophthora infestans*, described in all the books as destitute of haustoria, possesses numerous ones which are extremely minute and filiform. Haustoria are simple or branched: (*a*) Simple and oval or spherical (*Cystopus candidus*, *Plasmopara viticola*. *Pl. epilobii*, *Peronospora leptosperma*, etc.); (*b*) Claviform and simple (*Bremia lactucæ*); (*c*) filiform and simple (*P. myosotidis*, *P. Schleideni*, *P. affinis*. *P. chloræ*, *Phytophora infestans*); (*d*) ramified and claviform (*P. parasitica*); (*e*) ramified and filiform (*P. arborescens*, *P. calotheca*, etc.). Ordinarily the haustoria have a double envelope and between these two envelopes irregular and voluminous masses of callose often occur and sometimes rupture the exterior membrane (*Cystopus candidus*, *P. myosotidis*, etc.). At other times the exterior membrane shows only cellulose and incloses little callose. It then forms a complete sheath around the haustorium which can be removed in connection with the mycelium by a slight traction (*P. Schleideni*). Sometimes the masses of callose formed by the haustoria are so abundant that they fill the entire cavity of the cell, the protoplasm being crowded against the wall.

Masses of callose in a state of purity are also found in the cavity of the conidiophores. They take the form of rings or irregular plugs, of most variable location. In any case these plugs can not be likened to the septa which form at the base of the sporangium of the Mucorinæ, as has been done. The only part of the conidiophores where the presence of callose is constant is the base of the conidia where this substance plays an important role in the dissemination of the spores.

To sum up, the constant presence of callose in the mycelium of the Peronosporinæ enables us to recognize with great clearness the least traces of these parasites in the host plants and to show clearly the relations which exist between the latter and the parasite.

(4) This paper is really a continuation of the last one. Observations on the formation and the separation of the conidia in *Cystopus candidus* led M. Mangin to the following conclusions: The septum first appears as a delicate ring of callose on the thin inner wall of the basidium. This ring gradually enlarges until only a small central opening remains. The septum then appears as a funnel minus its tube, the convexity of which projects toward the base of the basidium. The open central portion of the septum finally closes. About this time or a little sooner the thin cellulose wall of the basidium disappears at the level of the callose (is absorbed) and a constriction rapidly takes place, the base of the new conidium and the summit of the basidium rounding off by the

extension and growth of the cellulose membrane. The conidium is now attached to the basidium by a mass of callose in the form of a little cup embracing the slightly pyriform base of the conidium. The base of this cup is convex or plane, but the center often shows a little pit which is the last vestige of the previous funnel-form orifice.

No division of the connecting cupule into three layers, as described by Zalewski, was observed. At this stage it is pure callose. Soon the cupule contracts, its superior edges being reduced progressively, and it shortly takes on the form of a cylindric fragment uniting the conidia, but the cellulose membrane of the conidium or of the basidium is not yet continuous across the callose. Subsquently the cellulose wall of the upper part of the basidium is continued along the base of the callose plug or through it when the latter projects. A similar process takes place a little later at the lower end of the conidium when the cup form has almost disappeared. Sometimes this cross wall is outside of the callose band, sometimes it grows through it, imprisoning a portion within the conidium. It is generally only when the conidium is second in rank from the basidium that the cellulose membrane is completed. Up to this point the changes in the callose band have been due to absorption, but not so subsequently. The band of callose now changes chemically so as to become strongly hygroscopic and completely soluble in water or even in the vapor of water. This primary septum or connective band contains no pectin compounds and does not swell and become gelatinous previous to solution, as stated by de Bary and Zalewski. It is simply a very neat case of liquefaction.

New conidia are developed under the old ones in the following manner: The end of the basidium elongates by intercalary growth and a new ring of callose appears. This is not always in the same plane, but most often for each conidium or group of conidia it appears in a region nearer the summit, so that the lateral wall of the basidium presents a series of thickenings, which when stained appear as striæ. Each one of these striæ corresponds to a group of conidia, for they are always less numerous than the conidia successively developed from a basidium.

The formation of conidia finally ceases, and in old sori, long ruptured, it is easy to find such exhausted basidia drawn out to a naked point or terminated by a single conidium which appears to be incapable of completing its development. The membrane of the basidium is then notably thickened in the terminal region and more or less deformed. The striæ above mentioned are often visible and, finally, several rows of internal button-shaped thickenings are almost always present. These thickenings are composed either of pure callose or of a mixture of callose and cellulose.

The statements here given were also found to hold good for *Cystopus cubicus* and the closely related *C. spinulosus*. A somewhat similar method of growth and delimitation was studied in a form of *Plasmopara* found on *Epilobium montanum*. Here, however, the cellulose wall

at the base of the spore is reflected over the upper surface of the callose somewhat early, but fades out toward the center. At this time the extremity of the basidium is expanded funnel-form, and the callose septum is biconvex. Later the cellulose wall of the spore becomes complete, but in just what way the author was not able to determine. The expanded end of the basidium shrinks and finally becomes drawn out to a point by the time the spore falls, but, contrary to Cornu, the tip still retains its callose plug and is not covered by a cellulose wall.

Reasoning by analogy, the author thinks the disarticulation of conidia in Peronosporæ takes place by a uniform mechanism. The paper is followed by a good lithographic plate (in part 5).

The following methods were employed to distinguish cellulose, callose, and protoplasm: Sections were first placed for some time in eau de Javelle* to remove plasmic matters. They were then washed in water and placed on slides with the addition of some drops of an alcoholic solution of soda or very concentrated caustic potash. After ten or twelve minutes they were neutralized with acetic acid and stained. Cellulose is colored a beautiful blue by a concentrated solution of iodated phosphoric acid. The stain is deep and instantaneous, the treatment with alkalies rendering the cellulose easier to stain. For callose one of the blues formed of trisulphonated triphenylrosaniline and soluble in water should be used. Since some nitrogenous matters may yet remain, it is well to mix one of these blues with a solution of acid brown (Bismarck, Vesuvin, etc). This mixture must always be used in an acid medium (acetic acid 3 to 100, formic acid 3 to 100). The cuticle and all azotic substances become brown, the cellulose remains colorless, and the callose becomes a brilliant greenish blue. After the action of this mixture, which requires some minutes, wash in water and mount in aqueous glycerine, in which the specimens will remain without bleaching for some months. Preparations treated with iodated phosphoric acid may be preserved in the same way and will keep for a long time if protected from the light.

In a footnote the author recommends the following dyes as especially serviceable: (1) For protoplasm, lignin, cutin, and pectin compounds: Blue de diphenylamine soluble in alcohol, blue de Bayer soluble in alcohol, bleu direct; bleu d'analine soluble in alcohol, bleu de gentiane 6B., bleu opal, bleu de nuit, bleu lumière. These blues do not stain callose. (2) For callose and protoplasm: Le bleu Nicholson 6B., le bleu soluble BLSE, le bleu coton C4B, from the house of Poirrier et Dalsace at St. Denis; le bleu brillant verdâtre pour coton, le bleu papier V, from Bayer et Cie at Flers near Roubaix; les bleus alcalins 6B, bleus nouveaux, G et R, from L. Cassella, Lyons: bleu de Bayer DBF, from Badische Analine Soda Fabrik, Neuville sur-Saône. These colors are soluble in water. They stain protoplasm a deep blue and callose a greenish blue; also lignin slightly. They do not stain cellulose. (3) For pectin compounds:

*Kaliumhypochlorite.

The azo acid browns, such as the Bismarck browns (Vesuvin, brun d' aniline). These do not stain cellulose or callose. (4) For protoplasm, lignin, and cutin: The acid browns of variable composition, often having no relation to Bismarck browns. These are salts of soda of which the coloring matter is the base. They are soluble in water. They stain protoplasm brown, and certain stain cellulose rose color, but feebly. They color lignin and cutin deeply in an acid bath. They do not stain pectin or callose compounds. They also mix with the soluble blues without precipitation and consequently are very suitable for the preparation of double stains, by means of which callose can be distinguished very readily in the midst of tissues rich in nitrogenous matters—ERWIN F. SMITH.

PECK, CHARLES H.—*Annual Report of the State Botanist of the State of New York.* Forty-fourth Rept. N. Y. State Mus. Nat. History: Albany, 1891, pp. 75, pl. 4.

The above was distributed to botanists during December, 1891, and is the most extensive contribution to systematic mycology issued during the year in this country. Prof. Peck continues his observations on fungi and gives descriptions of many new species, some of which are illustrated. In speaking of the liability of plants to the attacks of fungi, he says that certain species of spruce trees in a starved and unthrifty condition were attacked by *Peridermium decolorans*, while those in a healthy condition were exempt. The New York species of *Tricholoma* are monographed in a manner similar to genera in previous reports, forty-seven species being described. There is also given a notice of a manuscript volume by Mary E. Banning, which contains descriptions of some new species. The figures are colored by hand, and all the species were collected in Maryland. They are mostly Hymenomycetes and Gastromycetes. Fourteen new species are described.

The following is the contents of the report: (A) Plants added to the herbarium, including many species of fungi (pp. 9–11). (B) Contributors and their contributions (pp. 11–14). (C) Species of plants not before reported (pp. 15–30), with the following new species: *Armillaria viscidipes*, *Tricholoma grande*, *Clitocybe fuscipes*, *Collybia expallens*, *Omphalia corticola*, *Pleurotus pubescens*, *P. campanulatus*, *Flammula squalida*, *Crepidotus distans*, *Cortinarius albidus*, *Dædalea sulphurella*, *D. extensa*, *Hydnum arachnoideum*, *Odontea tenuis*, *Mucronella minutissima*, *Thelephora odorifera*, *Cyphella arachnoidea*, *Phyllosticta ludwigiæ*, *Dothiorella celtidis*, *Diplodia liriodendri*, *D. multicarpa*, *Septoria pteridis*, *Septomyxa carpini*, *Aspergillus aviarius* (found in the visceral cavity of a canary and supposed to have caused its death), *Sporotrichum Lecanii*, *Diplosporium breve*, *Ramularia destruens*, *R. junci*, *R. graminicola*, *Cercosporella veratri*, *Bispora effusa*, *Septonema episphæricum*, *Caryospora minor*, *Metasphæria nuda*, *Pseudopeziza pyri*, *Saccharomyces betulæ*, Pk. & Pat. (D) Remarks and observations (pp. 30–38) including

remarks on fungi and descriptions of new varieties and one new species, as follows: *Pleurotus atrocæruleus*, var. *griseus*. *Coniophora puteana*, var. *tubuculosa* and *rimosa*. *Vibrissea truncorum*, var. *alpipes*. *Agaricus campestris*, var. *griseus*. *Armillaria mellea*, var. *radicola*, and *Tricholoma maculatescens*. On page 36, under *Fusicladium destruens* it is noted that the presence of this species and others is a consequence, and not the cause of the death of oat plants. (E, pp. 38–64). New York species of Tricholoma, giving keys, and descriptive notes. (F, pp. 64–75.) Fungi of Maryland, with descriptions of new species by Mary E. Banning as follows: *Amanita pellucidula*. *Tricholoma rancidulum*. *T. edurum*; *T. subdurum*. *T. magnum*. *Clitocyle aquatica*. *Collybia siticulosa*. *C. subrigua*. *Pholita rubecula*. *P. mollicula*. *Hypholoma subaquilum*. *Coprinus virgineus*. *Russula viridipes*, *Boletus ignoratus* and *Hydnum cæspitosum*.

The plates accompanying the report are about up to the usual standard, but are not what might be expected from a rich State like New York. They would, too, have been rendered much more convenient for use had there been some indication given as to the page where the figured species is described. As there is no index one must look through the whole of the text to find the description of any desired figure.—JOSEPH F. JAMES.

SOLMS-LAUBACH, H. GRAF ZU. *Fossil Botany, being an introduction to Palæophytology from the standpoint of the botanist*. English translation by Garnsey. Revised by Balfour. Oxford: Clarendon Press. 1891, pp. 401.

This book concerns itself only with the remains of ancient plants, *i. e.*, with little or nothing more recent than genera dating from the Carboniferous era, and not at all with Dicotelydons. A part of one page only is devoted to fungi, and the statements are so concise and comprehensive that they may be quoted in full:

"Schimper gives us a long list of fungi and lichens which have been described by older writers. Where these are not merely spots on leaves, but actual Pyrenomycetes, Discomycetes, and Basidiomycetes growing on leaves or pieces of fossil wood, they still have no value except in showing what was probable without them, namely, that fungi formed a part of the ancient floras. When Polypori and Lenzites occur, as in the brown coals, it is not surprising that we should also find silicified woods which have been half destroyed by their mycelia. Such mycelia from the wood of the Tertiary have been described by Unger under the name of Nyctomyces. That there were fungi in the older formations also is proved by the fragments of thallus with local bladder-like swellings which are occasionally found in the tissue of stems of Lepidodendron, and which have been figured by Williamson under the name of Peronosporites antiquarius, Worth. Smith. Similar objects have been mentioned by other writers also—for example, by Renault and Bertrand under the name of Grilletia sphærospermii—from seeds of the period of the coal measures found in the siliceous fragments of Grand Croix. A form described by Ludwig from coal seams in the Urals as Gasteromyces farinosus may be nothing more than an aggregate of spores and spore tetrads of some archegoniate plant. That bacteria destroyed the substance of dead plants during the period of the Coal measures, as they do at the present day, is rendered extremely probable by the researches of Van Tieghem, who has

shown that the macerated vegetable fragments in the pebbles of Grand Croix exhibited the same progressive demolition of cell wall which is observed in modern cases. Van Tieghem even believes he has seen his Bacillus Amylobacter in a silicified state."—ERWIN F. SMITH.

VIALA, PIERRE. *Monographie du Pourridie des Vignes et des Arbres fruitiers.* Montpellier, 1891, pp. 121, pl. 7.

This monograph constitutes a thesis presented to the Paris Faculty of Sciences by Mons. Pierre Viala for a doctor's degree. It comprises the results of eight years work, and shows important additions to the status of the subject as recorded in the article on Pourridie in "*Maladies de la Vigne.*"

The thesis is divided into three parts. The first is historical, and treats briefly the relation of *Agaricus melleus*, *Vibrissea hypogæa*, *Fibrillaria* and *Dematophora* to Pourridie. The second part is confined to the last of these, which the author considers the principle cause of Pourridie. *Dematophora necatrix* is a species chosen for investigation, because, with the exception of a few sandy places, this is the only species of Dematophora found on vines attacked by Pourridie.

The parasitic and saprophytic nature of the fungus is fully discussed. The former has been fully proven by experiments, but is exhibited only by certain forms of the mycelium, the fruit being never produced until the host is killed.

Five forms of mycelium are distinguished—a white flocculent mycelium, a brown mycelium, root-like cords, *Rhizomorpha fragilis*, var. *subterranea*, *Rhizomorpha fragilis*, var. *subcorticalis*, and an internal mycelium. The Rhizomorpha forms agree externally with those bearing the same name, but belonging to *Agaricus melleus*, but the specific differences are carefully pointed out.

The fruiting forms are as numerous as those of the mycelium: they are chlamydospores, sclerotia, conidia, pycnidia, and perithecia. The two latter forms are here described for the first time, and, judging from what is known of other fungi, they complete the life history of the parasite. The development of these hitherto unknown forms was obtained by a special variation of the conditions under which the artificial cultures were made. Under the most favorable circumstances the pycnidia require from one year to a year and a half from the sowing of the spores to arrive at maturity; and the perithecia two years and a half.

The author has made many valuable experiments to ascertain the vitality of the fungus, the proper conditions for its development, and its resistance to fungicides. These are of especial economic importance. Much space is given to a detailed morphological description of all the forms of the fungus, especially of the mycelium.

A description of *Dematophora glomerata* is also included in the second part of the thesis. The mycelium, sclerotia, pycnidia, and conidiophores are described. The third part includes descriptions of the following forms which are often confused with Pourridie. *Fibrillaria*

(*Psathyrella*) *ampelina*, *Speira densa*, n. sp., *S. dematophoræ*, n. sp., and *Cryptocoryneum aureum*, n. sp.—EFFIE A. SOUTHWORTH.

WARD, H. MARSHALL. *Croonian Lecture: On some Relations between Host and Parasite in certain Epidemic Diseases of Plants.* Read February 27, 1890. Proc. Royal Society, London, vol. 47, No. 290, pp. 393–443, figs. 15.*

The study of plant diseases has shown rapid progress during the past decade and disciples of this branch of botany have reason to hope for still greater progress in the near future. Few, however, would have supposed that a work of the scope and value of the one before us would be possible at the present day. Prof. Ward has long been justly famed both for his successes in original investigations and for his happy faculty in expressing his results in the most lucid English. In the present lecture the author treats one of the most difficult, and at the same time one of the most important, subjects in the range of vegetable pathology. The introduction deals with the general subject of the relations existing between host and parasite. The author shows the close connection of normal life processes (physiological) and the abnormal ones (pathological), and insists that students in each branch must know what those in the other are doing. Then the behavior of the normal tissues is taken up and the fundamental processes going on in living cells are sketched.

The next section is concerned with the death of the cell, the author concluding with the following paragraph:

> Between the normal life, *i. e.*, the condition of affairs where the life processes are going on actively, and the state of permanent death, then, there are all possible gradations; many of these gradations coincide with the phenomena of disease—pathological conditions—and it is toward this difficult domain that I have now to carry the discussion.

Then the variations in environment as effecting the physiological processes in the host are considered, and the consequences of variations in temperature, in intensity of light, in the amount of aqeuous vapor in the atmosphere, etc., are shown. What is of special interest to workers in plant diseases is that the effects of these variations as predisposing causes to certain diseases are explained. The case is considered of a herbaceous plant growing in midsummer, which has previously been well supplied with heat and light. Then suddenly cold, dark, rainy weather sets in, and as a net result the parenchymatous tissues are particularly tender and watery, the cell walls thin and soft, the protoplasm more permeable and less resistant; the cell sap contains a larger amount than usual of organic acids, glucose, and soluble nitrogenous materials.

After rapidly sketching the state of our knowledge of the species of *Botrytis* which may under some circumstances cause widespread epidemics

* The number containing the article can be obtained from Harrison & Sons, 45–46 St. Martin's Lane, London, W. C., England, for 1 shilling 6 pence.

among plants, the author shows that these fungi must have a somewhat acid medium to grow upon; yet they require a sugar of some kind, preferably glucose, and asparagin or peptone may be advantageously offered as soluble nitrogenous foods. It is also true of these fungi that their optimum temperature for oxygen respiration is considerably lower than for higher plants, and unlike them, they require no light for their healthy growth. Dull, damp weather and a saturated atmosphere, so injurious to higher plants if long continued, decidedly favor the growth of fungi.

"Consequently," he says, "the very set of external circumstances which make the host-plant least able to withstand the entry and devastation of a parasitic fungus like *Botrytis*, at the same time favor the development of the fungus itself."

A number of examples are given of epidemic diseases caused by *Botrytis* both artificially induced and occurring in nature. Of the latter the lily disease so destructive in England during the very wet, cold, and dull summer of 1888 is given as an example. Prof. Ward has already published a full account of this epidemic in the Annals of Botany, Vol. 2, 1888, pp. 319–376.

The peculiar fact that the conidia of *Botrytis* on germinating produce germ tubes unable to penetrate living plant tissues is noted as well as the remarkable discovery that successive generations of parasitically or semi-parasitically nourished *Botrytis* acquire different powers of infection, becoming each time more powerful in the cases studied.

The last section of the lecture contains a summary of the factors of an epidemic, and this is of such general interest that it is quoted here in full.

It will be clear from the foregoing that in the case of an epidemic fungus disease, such as we have been considering, there are several classes of factors to be regarded, and I may sum up the chief points somewhat as follows: First, we have the normal healthy host-plant, with all its hereditary (internal) and adaptive peculiarities; secondly, we have the parasitic fungus, also with its disposition. Then we find, thirdly, that, apart from its inherent powers of variation, the host is subject to variable external influences during its life, which may produce such changes in the cell-walls and contents, &c., that the plant approaches nearer and nearer the limits of health, wide as we may regard these. On the other hand, we have, as a fourth consideration, the parasite also varying under the influence of changes in the factors of the environment, and its variations may, of course, be also dangerous to its welfare, but they may, on the contrary, be in such directions that it is enabled to profit by the counter-variations of the host. When the combined efforts of the physical environment are unfavorable to the host, but not so or are even favorable to the parasite, we find the disease assuming a more or less pronounced epidemic character.

It is not pretended that we have here a totally new idea, because it has long been known that some organisms which bring about parasitic diseases do vary in the intensity of their effects, and can be made to do so artificially, and we know that some of the most brilliant results in biology have been obtained in connection with certain lower organisms; but I have simply sought to show some of the links in the chain of causes and effects in the definite case of certain epidemic diseases of plants produced by the parasitism of some of the more highly developed fungi, and this, I think, has not

been done before. If the preceding argument is admissible, new light will be thrown not only on the cases of parasitism referred to, but also on the behavior of the host in its struggle for existence with the factors of the inorganic environment, generally.

Finally, the bearing of the discussion on other parasitic diseases is considered, and short but very suggestive paragraphs are given to a number of fungi causing diseases; among them *Phytophthora infestans*, Nectrias and wood destroying Hymenomycetes, the Ustilagineæ and Uredineæ. Copious footnotes add to the value of the paper, which should be in the hands of every student of plant diseases.—W. T. SWINGLE.

INDEX TO LITERATURE.

In the following index all articles from foreign sources are indicated by the numbers prefixed being in heavy-faced type. All those with the ordinary type relate to American literature.

A.—WORKS OF A GENERAL NATURE.

331. Atkinson, George F. **The botanical section of the American Association of Agricultural Colleges and Experiment Stations, Washington meeting.** Bot. Gazette, vol. 16, Sept. 15, 1891, pp. 264–267. A notice of papers read before the Association in August, 1891. Refers to paper by Alwood on "A fungous disease upon apple leaves:" Garman, "A bacterial disease of cabbages:" Discussed by Alwood, Atkinson, and Halsted. Brunk on "Treatment of *Cladosporium fulvum*;" Atkinson on "Fungous diseases of the cotton plant," (exhibition of drawings); Pammel on "A destructive disease of the cherry;" Halsted on "Notes upon *Monilia fructigena* and spore germination." (See Nos. 389, 409, 430, and 542.) (J. F. J.)

332. Brandegee, T. S. **Harvey Wilson Harkness.** Zoë, vol. 2, No. 1, San Francisco, April, 1891, pp. 1–2, pl. 1. A short biographical sketch with portrait. (D. G. F.)

333. Brioschi, F. **Relazione del Presidente.** Atti Reale Acad. Lincei, 4ª ser., vol. 7, Rome, 1891, fasc. 11, adunanza solane d. 7 giugno, pp. 489–495. On pp. 492, 493, mentions the awarding of half a prize of 10,000 lire to Saccardo for his work "Sylloge fungorum omnium hucusque Cognitorum" with a mention of its scope and usefulness. (W. T. S.)

334. Cooke, M. C. **Confessions of a Mycophagist.** Grevillea, vol. 19, No. 91, London, March, 1891, pp. 67–71. Contains remarks on fungous forays and edible fungi; an account of the manner in which the author became a student of the fungi, and a plan for making colored sketches of Agarics. (M. B. W.)

335. Galloway, B. T. **The parasitic enemies of cultivated plants.** The Chautauquan, vol. 14, No. 3, Meadville, Pa., Dec., 1891, pp. 297–302. Gives in popular language a discussion of the nature and causes of plant diseases with an account of the recent advances in the region of economic mycology, special reference being given to the advances made in the use of copper compounds as fungicides. (D. G. F.)

336. [? Masters, M. T.] **Mushrooms and their culture** (by C. Brooks). Gard. Chron., 3d ser., vol. 10, No. 253, London, Oct. 31, 1891, p. 518, ⅛ col. Review. The author states that the work is full of misstatements, erroneous ideas, and bad English. (M. B. W.)

337. [? Masters, M. T.] **Mushrooms at the Chicago Exhibition** (by C. Brooks). Gard. Chron., 3d ser., vol. 10, No. 258, London, Dec. 5, 1891, p. 676, $\frac{1}{16}$ col. Notes that casts of the edible mushrooms of the U. S. are to be exhibited. (M. B. W.)

338. [? Masters, M. T.] **Plant diseases.** Gard. Chron., 3d ser., vol. 10, No. 256, London, Nov. 21, 1891, p. 617, ⅛ col. Commends the Journal of Mycology, and suggests that an organization for the investigation of fungous diseases of plants would advance matters in England. (M. B. W.)

339. Prain, D. **A list of Diamond Island plants.** Jour. Asiatic Soc. Bengal, new ser., vol. 59, Bengal, 1890 (Mar. 14, 1891), pp. 271-294. Mentions four species of fungi (p. 285) found on the island, all occurring on dead wood. (J. F. J.)

340. Solms-Laubach. **Fossil botany**, being an introduction to Paleophytology, from the standpoint of the botanist; translated by Henry E. F. Garnsey; revised by I. B. Balfour. Clarendon Press, 8vo, Oxford, 1891, pp. 401, many figs. See review, p. 148. (E. F. S.).

341. Whitehead, Chas. **Methods of preventing and checking the attacks of insects and fungi.** Jour. Roy. Agric. Soc., 3d ser., vol. 2, London, June 30, 1891, pp. 217-256, figs. 26. A comprehensive paper mentioning many of the fungous diseases of plants, with history and treatment, formulæ for fungicides, and 23 figures of machines for their application. The subject is presented under four heads, viz: Corn crops, root and vegetable crops, fruit crops, and hops. Attention is about equally divided between fungi and insects. (M. B. W.)

B.—DISEASES OF NONPARASITIC OR UNCERTAIN ORIGIN.

342. Alwood, W. B. **Diseases of plants.** Southern Planter, 52d year, No. 10, Richmond, Oct., 1891, pp. 552-553. Remarks presence in Virginia of peach yellows, where it has laid waste a large portion of the best peach-growing region of the State. Refers to inquiries from California in regard to Virginia nursery stock. Author has not seen the yellows in the nurseries. Notices presence of black rot of grapes controllable by weak formula of Bordeaux mixture and calls attention to presence of leaf spot of the apple distinct from the apple rust caused by *Ræstelia*. (D. G. F.)

343. Bailey, L. H. **Peach yellows.** Cornell Univ. Agric. Ex. Sta., Bull. 25, Ithaca, Dec., 1890, pp. 178–179. Notes presence and spreading of yellows in New York State; also work of Dr. Erwin F. Smith in Maryland. (D. G. F.)

344. C[ollins], A. L. **Causes of die back.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 8, Jacksonville, Feb. 19, 1891, p. 143. Discusses cause of die back in oranges. Thinks due to overstimulation by nitrates. (D. G. F.)

345. Galloway, B. T. **La Maladié de la vigne en Californié.** [The vine disease of California.] Progres Agricole et Viticole, 8 Ann., No. 48, Montpellier, Nov. 29, 1891, pp. 509–512. Gives brief notice of the work of the special agent, Mr. Pierce, on the California vine disease, as given in his preliminary report, not yet published. (J. F. J.)

346. Goethe, R. **Eisenvitriol als Heilmittel der Gelbsucht der Obstbäume.** Bericht K. Lehranstalt für Obst und Weinbau, Jahrg. 1889–1890, Wiesbaden, 1891, p. 30–31. Reviews Sachs's work on the treatment of chlorotic plants. Tried experiments with iron sulphate on several varieties of fruit trees with very favorable results. One kg. of iron sulphate was used for smaller trees, 2 kg. for larger. Mentions certain varieties of pear and apple which need more iron and consequently are more subject to disease. Treated trees were less attacked in some cases by the leaf *Aphis* and *Schizoneura*. (W. T. S.)

347. Gillett, M. E. **Sour stocks the only preventive of foot rot.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 44, Jacksonville, Oct. 29, 1891, p. 871. Reports doubtfully the successful use of sour stocks as a preventive of the foot rot. (D. G. F.)

348. Hart, W. S. **American Pomological Society meeting in Washington, Sept. 22, 23 and 24, 1891.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 40, Oct. 1, 1891, pp. 783–784. Notes on method of exposure of roots and washing of same as a cure for the Mal di Goma or foot rot. Also petition of secretary of Interlachen Hort. Society, that agent of U. S. Department of Agriculture be sent to investigate the orange diseases of Florida. (D. G. F.)

349. Hart, W. S. **Foot rot does attack sour stocks.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 45, Nov. 5, 1891, p. 891, 2 cols. Discusses in popular language the foot rot of oranges, claiming the disease is present on sour stock,

although sour stocks are more resistant than sweet stocks. Thinks no remedy has been found for the disease, although exposure and washing of roots has seemed to give good results. (D. G. F.)

350. HEIMERL, Dr. ANTON. **Zur Beseitigung der Chlorose.** Wiener illust., Garten-Zeit., 16 Jahr., Wien, August–Sept., 8 n. 9 heft 1891, pp. 331–335. Pale leaves may be due to three causes: (1) lack of light, etiolation; (2) lack of heat; (3) lack of iron. Author speaks especially of the pale leaves due to the last mentioned cause, giving a résumé of the work of Sachs on the subject. Quotes from Sachs the method of treatment: 2–3 or even 6–8 kilograms of iron sulphate is mixed with earth in ditches radiating from the tree between the principal roots or encircling the tree at a distance of 5–10 decimeters from the trunk. Then the tree is liberally watered with 100–150 liters of water. Plants in pots may be immersed in a weak solution of iron sulphate. Explains the rather large quantity of iron sulphate required to take effect on large plants in part by the absorptive action of the soil, in part by the weakening of the power of the plant to absorb it. (W. T. S.)

351. HEWETT, C. B. **Trees, bugs, and disease.** Rural California, vol. 14, Los Angeles, Dec., 1891, p. 727, one-third col. States belief that as peach yellows thrives in a damp and rainy climate it would not exist in the dry air of California. "I believe that if a tree affected by the yellows could be taken up and transplanted from an orchard in the East to our soil and climate that unless too far gone it would revive and get over it entirely." (J. F. J.)

352. JACKSON, J. F. **Peach yellows.** Southern Planter, 51st year, No. 2, Richmond, Feb., 1890, pp. 60–61, one-fourth col. Notes the introduction of peach yellows bill into the Virginia State legislature. (D. G. F.)

353. KING, WM. R. **Mal di Goma.** Bull. U. S. Dept. of Agric., Div. of Pomology, No. 4, Washington, Feb., 1891, pp. 18–19. Describes characteristics of the disease; considers cause as not certainly known, but seemingly of possible bacterial origin; as certainly contagious by use of infected instruments. Recommends as preventive measures: (1) Budding on resistant stocks—wild sour orange, rough lemon or pomelo; (2) planting on dry porous soil if sweet stock be used; (3) careful irrigation, keeping the water from the trunk of the tree; (4) prompt removal and destruction of diseased portions. Quotes from Lelong recommending mixture of 1 peck fresh lime, 4 pounds of copperas, 5 pounds sulphur, mixed in enough water to slake the lime, and keep covered as a good disinfectant paint. (See also Rural Californian, vol. 14, Dec., 1891, p. 718; Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, June 18, 1891, p. 495.) (D. G. F.)

354. LELONG, B. M. **Peach yellows.** Pacific Rural Press, vol. 42, San Francisco, Oct. 10, 1891, pp. 301, 312, pl. 1, map 1. Describes the yellows as it appears in New Castle County, Del., quoting from Bulletin No. 9, Div. Veg. Pathology, and giving plate from same bulletin, and enlarged map of distribution of yellows and rosette in the United States, prepared with aid of Galloway and Smith. An appeal to fruit growers to guard against introduction of disease into California through purchase from unreliable nurseries. (D. G. F.)

355. LELONG, B. M. **Peach yellows. A warning to fruit growers. Danger of introduction into California. Warning to intending purchasers and recommendation.** Cal. State Board of Hort., Sacramento, 1891, pp. 25, pl. 4, 1 map. Discusses the dangers of introduction of disease into California. Gives map showing extent of the disease, extracts from correspondence with large number of eastern horticulturists. Quotes from work by Dr. Erwin F. Smith and proposed ordinance passed by the county board of horticultural commissioners of San Bernardino County. Gives copies of horticultural laws of California and peach yellows laws of Michigan and New York. (D. G. F.)

356. LOS ANGELES EXPRESS. **A risky experiment.** Rural Californian, vol. 14, Los Angeles, Dec., 1891, p. 753, one-fourth col. Refers to statement of theory

that peach yellows will not thrive in California. Argues that stock should not be imported from infected regions and that home grown, *i. e.*, California stock, should alone be used. (J. F. J.)

357. Lugger, Otto. **Disease of flax.** Biennial Rep. Minn. Agric. Ex. Sta., ending Dec., 1890, Minneapolis, 1891, p. 19. Notes destructive disease of flax near Windom, Minn., and promises further report upon experiments in its prevention. Noted as a contagious disease, but cause not given. (D. G. F.)

358. Manville, A. H. **Will foot rot attack the sour stock?** Fla. Disp., Farmer and Fruit-Grower, new ser., vol. 3, No. 41 Jacksonville, Oct. 8, 1891, pp. 803–804, 1 col. Expresses doubt as to occurrence of the foot rot of oranges upon sour stocks. (See also Rural Californian, vol. 14, Dec. 1891, p. 724.) (D. G. F.)

359. [?Masters, M. T.] **Cucumber disease.** Gard. Chron., 3d ser., vol. 10, London, July 18, 1891, p. 75, $\frac{1}{10}$ col. Notes receipt of specimens of diseased cucumbers with nodules on roots. (M. B. W.)

360. [?Masters, M. T.] **Peach yellows.** Gard. Chron., 3d ser., vol. 9, London, Feb. 28, 1891, p. 274, $\frac{1}{8}$ col. Notes the receipt of specimens of peach yellows from the Cape of Good Hope, and states that the disease is unknown in England. (M. B. W.)

361. [?Masters, M. T.] **Tomato diseases.** Gard. Chron., 3d ser., vol. 9, London, May 9, 1891, p. 593, $\frac{1}{2}$ col. Notes the receipt of diseased tomato plants, in which neither insects nor fungi could be found, with description of external characters. (M. B. W.)

362. Mayet, Valery. **Rapport sur une maladie affectant les citronniers dans l'arrondissement de Calvi.** Ministere de l'agric. Bull., 1891, No. 5, 10th yr., Paris, Oct., 1891, pp. 449–456. Contains an interesting account of gummosis or foot-rot of citron trees in the north part of Corsica. The disease is thought to be the same as one which formerly attacked orange trees in S. E. France, Italy, and Portugal, and analogous to a disease of pomaceous trees in Normandy, reported on by Van Tieghem, in Ann. Soc. Bot. de Fr., 1879. It is believed to be of nonparasitic origin and due to a series of rainy seasons, to excessive irrigation, or to any other cause which, by depriving the roots of air, compel them to derive oxygen from stored sugar with the formation in the tissues of alcohol and CO^2 and the series of symptoms described. In other words the disease is ascribed to asphyxia of the roots, and may be called "pouridie without fungi." It has done great injury in Corsica. (E. F. S.)

363. Rhind, Duncan. **Peach yellows and its remedy.** Cult. and Country Gent., 61st year, No. 2027, Albany, Dec. 10, 1891, pp. 996–997, 1 col. States belief that disease is caused by overcropping, combined with excess of moisture, growing varieties not hardy, and growing late varieties that can not properly ripen wood. Advocates grafting on hardy stock, such as plum and almond. Believes disease to be due to impaired vitality, and must be treated by each orchardist for himself according to circumstances. (J. F. J.)

364. Rural Californian. **Bugs and diseases.** Rural Californian, vol. 14, Los Angeles, Dec., 1891, p. 727, $\frac{1}{4}$ col. Quotes resolutions adopted by convention of fruit-growers in Marysville, Cal., against importation of nursery stock, peach, apricot, etc., from regions infected with "yellows." (J. F. J.)

365. Rural Californian. [**Peach yellows in Connecticut**]. Rural Californian, vol. 14, Los Angeles, Dec., 1891, p. 723, $\frac{1}{4}$ col. Refers to presence of yellows in Connecticut and notes recommendation to destroy all trees affected with the disease. (J. F. J.)

366. Scientific American. **Peach yellows.** Scientific American, vol. 65, New York, Sept. 26, 1891, p. 194, $\frac{1}{4}$ col. Quotation from New England Farmer referring to belief that the disease is a symptom of starvation, and can be cured by potash and nitrate of soda, 10 pounds of the former to 5 of latter. Also notes the belief by M. P. Augur that disease is caused by microscopic germs. Refers to work of Erwin F. Smith. (J. F. J.)

367. Smith, Erwin F. **Additional evidence on the communicability of peach yellows and peach rosette.** Bull. U. S. Dept. of Agric., Div. Veg. Path., No. 1, Washington [Dec.], 1891, pp. 65, pl. 39. Comprises the author's investigations, covering a period of three years, into the nature and communicability of peach yellows, and the characterization of a new disease of the peach in Georgia and Kansas. Gives series of inoculation experiments with the yellows conducted in Maryland, together with 50 excision experiments in seven different orchards, which, in connection with a series of experiments bearing upon immunity of the disease, warrant the author in drawing the following conclusions: (1) That the disease is contagious; (2) that it may be conveyed by seemingly healthy buds when these are taken from diseased trees; (3) that only a very small quantity of infectious material is necessary, provided it be in the form of living cells which can be induced to unite with the actively growing tissue of the tree; (4) that the disease has a longer period of incubation than has been customary to suppose; (5) that the death of the entire tree occurs, ordinarily, only after a very considerable period, *i. e.*, several years. The peach rosette, upon which a most successful series of bud inoculation experiments is reported, is found to differ from the yellows in eight characteristic features. The author's experiments with buds taken from wholly diseased trees and from the healthy side of a diseased tree resulted in transmission of the disease in the former case, and healthy growths in the latter. The author concludes in regard to this remarkable disease: (1) That it is virulently contagious; (2) that it may exist for a short time in a part of the tree without being present in the rest; (3) that it has gained a strong foothold in Georgia and is on the increase; (4) that the necessity for prompt concerted action on the part of Georgia peach-growers by removal of all diseased trees is very great. (D. G. F.)

368. Smith, Erwin F. **Chemistry of peach yellows.** Cult. and Country Gent., vol. 56, No. 2021, Albany, Oct. 22, 1891, p. 859, ½ col. Short abstract of paper read before the 23d biennial meeting of the American Pomological Society. Reported by T. G. R., giving a few results of treatment by fertilizers. (D. G. F.)

369. Smith, J. H. **A disease of lime trees.** Fla. Disp., Farmer and Fruit-Grower, new ser., vol. 3, No. 42, Jacksonville, Oct. 15, 1891, p. 827, ½ col. Notes a peculiar disease causing blossoms to fall in spring and leaves to become knotty. (D. G. F.)

370. Webster, W. H. **Apricot disease.** Pacific Rural Press, vol. 42, San Francisco, July 11, 1891, p. 28, ¼ col. Gives complaint of apricot disease known as die-back, said by editor to be "an old complaint." (D. G. F.)

(See also Nos. 411, 412, 433, 470, and 507.)

C.—DISEASES DUE TO FUNGI, BACTERIA, AND MYXOMYCETES.

A.—RELATIONS OF HOST AND PARASITE.

371. Dangeard, P. A. **Note sur les Mycorrhizes Endotrophiques.** Le Botaniste, 2e ser., 5e fasc., Paris, May 1, 1891, pp. 223–228, figs. 8. Discusses in more or less general way symbiotic action of fungi and roots of phanerogams, and describes the presence of a species of endotropic Chytridiaceæ, *Cladochytrium tmesipteridis* n. sp., which the author concludes is probably parasitic in the rhizomes of *Tmesipteris vieillardi*, although in some respects apparently in symbiotic relations with the host. A second species of *Mycorrhiza* found growing upon the same rhizomes the author believes is probably identical with either Wahrlichs' *Nectria goroshankiniana* or *N. ramulorum*. He is disposed to consider this latter species together with a third fungus found in connection, the name of which is not given, as being of use to the plant. The study is made from herbarum specimens only. (D. G. F.)

372. Heimerl, Dr. Anton. **Ueber Symbiose. Vortrag, gehalten am 6 März, 1891 in der k. k. gartenbau Gesellschaft.** Wiener illust. Gart. Zeit., 16 Jahr., Wien, 4 heft April, 1891, pp. 138–146. Mentions in course of a popular lecture *Mycorrhiza*, and the *Rhizobium leguminosarum* in root tubercles of Leguminosæ. Gives a résumé of recent work on the absorption of free nitrogen by Leguminosæ, and discusses the part played by the fungus in the act. (W. T. S).

373. Lyon, W. S. **Damping off.** Garden and Forest, vol. 4, No. 199, New York, Dec. 16, 1891, p. 599, ½ col. Refers to statement frequently made that disease germs are on the seeds, but says he was unable to find any. Considers fine pulverizing of the soil and then sprinkling to be especially favorable to spread of disease. Concludes the disease germs are in the soil, as contended by Halsted. (J. F. J.)

374. [? Masters, M. T.] **Parasitic fungi in relation to plant diseases.** Gard. Chron., 3d ser., vol. 9, London, Feb. 14, 1891, p. 211, ½ col. Syllabus of three lectures to be delivered by C. B. Plowright before the Royal College of Surgeons, England. (See also *Ibid.*, Jan. 24, 1891, p. 114.) (M. B. W.)

375. [? Masters, M. T.] **Parasitism in plants.** Gard. Chron., 3d ser., vol. 9, London, May 16, 1891, p. 620, ⅛ col. Notes a lecture given by Prof. H. Marshall Ward, in the Royal Botanic Gardens, on "Problems of Parasitism in Plants." (M. B. W.)

376. Ráthay, Emerich. **Ueber myrmekophile eichengallen.** Botanisches Centralbl. Bd., 49 No. 1, 13 Jahrg., Cassel, 9 Jan., 1892, pp. 12–13. A notice in Originalbericht gelehrter gesellschaften. k. k. zool. bot. Gesell. in Wien. Mentions a theory of Delpino that the spermogonia of certain rust fungi by attracting ants and other pugnacious insects, protect those leaves on which they occur, so that they may live to produce the Æcidia. (W. T. S.)

377. Rush, W. H. **Penetration of the host by Peronospora gangliformis.** Bot. Gazette, vol. 16, No. 7, July, 1891, pp. 208–209, fig. 1. Figures penetration of stomata of *Lactuca sativa* by germ hyphæ of conidia of *Peronospora gangliformis;* finds no case of penetration of epidermal cells, contrary to de Bary's observation. (D. G. F.)

378. Vuillemin, Paul. **Sur les effets du parasitisme de l'Ustilago antherarum.** Comptes Rendus, vol. 113, Paris, Nov. 9, 1891, pp. 662–665. It is well known that the pistillate flowers of *Lychnis dioica* take the appearance of hermaphrodites when invaded by this fungus. It was formerly supposed that when any flowers of a plant were attacked all were. The author shows that such is not the case. The flowers of a single branch may be invaded, while those of a neighboring one may escape. The base and lower branches may escape, while all the flowers in the top of the plant are affected. In other cases some small branches may be affected, among which the stem pushes out sound branches. Such partial attacks are common. The action of the parasite stimulates the development of the normally abortive stamens and the smut spores take the place of pollen grains and escape, and are distributed in the same way. The author thinks there is a symbiosis analogous to that in galls. He has found the stigmas of isolated and healthy plants powdered with spores of Ustilago, which he believes were transplanted from infected plants by visiting insects. (E. F. S.)

(See also Nos. 379, 381, 428, 432, 443, and 450.)

B.—DISEASES OF FIELD AND GARDEN CROPS.

379. Arthur, J. C. **Wheat scab.** Bull. Purdue Univ., Agric. Ex. Sta., vol. 2, No. 36, Lafayette, Aug. 25, 1891, pp. 129–132. Records presence near Lafayette of disease of wheat probably caused by a *Fusarium* more or less nearly related to *Fusarium* (*Fusisporium*) *culmorum* of W. G. Smith. Estimates damage from the parasite at from 10 to 20 per cent. Points out fact that the late plant-

ing of wheat greatly influences amount of "scab;" that planted late, and hence blooming late being worst affected. Considers vigorous growth and early blooming the chief safeguards against the disease. (D. G. F.)

380. Bolley, H. L. **A disease of beets, identical with deep scab of potatoes.** Bull. Gov. Agric. Ex. Sta., N. Dak., No. 4, Fargo, Dec., 1891, pp. 15–17, pl. 1. Describes disease and states it seems to be the same as that affecting potatoes. Occurs also on turnips, cabbage roots, and carrots. (J. F. J.)

381. Bolley, H. L. **Notes on potato scab.** Agric. Science, vol. 5, No. 9, La Fayette. Sept., (Nov. 7,) 1891, pp. 212–214. Gives result of investigations made in Dakota, in which the fungus characterized by Thaxter is found undoubtedly genetically connected with the disease. Considers it possible that his previous year's investigation may contain errors and acknowledges the superiority of Thaxter's fungus as a scab producer. (D. G. F.)

382. Bolley, H. L. **Potato scab, and possibilities of prevention.** Bull. Gov. Agric. Ex. Sta., N. Dak., No. 4, Fargo, Dec. 1891, pp. 1–14, 21–31, pl. 1, figs. 4. Discusses nature of potato scab, giving theories in regard to cause. Considers disease due to parasitic fungi and describes effects. Gives report of experiment for prevention of disease and recommends selection of sound potatoes for seed; gives also formula for treating seed before planting, as follows: Corrosive sublimate, 2 oz., dissolve in 2 gallons of hot water and leave all night; dilute with 13 gallons of water, stir thoroughly and immerse potatoes to be used for seed in mixture for 1½ hours; dry potatoes, cut and plant as usual. In appendix to article gives table of tests of effects of character of soil on the origin of the disease, together with statement of treatment adopted for prevention. Discusses the difference between surface and deep scab, leaving the subject in doubt as to whether the diseases are distinct or different forms of the same. (J. F. J.)

383. Chester, F. D. **Notes on three new or noteworthy diseases of plants.** Bull. Torrey Bot. Club, vol. 18, Dec. 1891, pp. 371–374. Refers to and describes (1) Anthracnose of the tomato, caused by *Colletotrichum lycopersici*, n. sp. (2) A leaf spot of celery, possibly caused by a new species, in which case it might be named *Septoria apii*. (3) Blight of watermelon vines caused by *Phyllosticta citrullina*, n. sp. (J. F. J.)

384. Claypole, Katherine B. **My garden on an onion.** Pop. Sci. Monthly, vol. 39, New York, May, 1891, pp. 72–76, figs. 3. Gives account in popular language of attacks of *Penicillium glaucum* and *Polyactis* sp. upon onion bulbs. Notes parasitism of *Baryeidamia* upon *Polyactis*. (See also International Jour. Micros. and Nat. Sci., 3rd ser. vol. 1, London, Nov., 1891, pp. 329–333, pl. 1.) (D. G. F.)

385. Coquillet, D. W. **Some pests of the horticulturist.** Rural Californian, vol. 14, Los Angeles, Dec., 1891, pp. 714–715. Refers to potato blight (*Phytophthora infestans*) and states results of use of Bordeaux mixture. Gives formula and recommends its use. (J. F. J.)

386. Crawford, J. M. **Cotton growing in Russia.** Reports from consuls of the United States, No. 130, Washington, July, 1891, pp. 425–430. Refers (p. 426) to the "rust" of cotton appearing in the Erivan district in 1888 after a wet summer. The disease had never before been observed on the plant known locally as "Kara-kosa," but in some localities it destroyed nearly one-half the crop. (J. F. J.)

387. Crozier, A. A. **Potato scab.** Agric. Science, vol. 5, La Fayette, No. 9, Sept., 1891. (Nov. 7, 1891, p. 215.) Gives results obtained from planting two rows of potatoes, the one of scabby tubers and the other of healthy ones. Concludes harvest from planting of healthy tubers, though partly scabby, better than the harvest from the planting of scabby tubers. (D. G. F.)

388. GALLOWAY, B. T. **Further observations on a bacterial disease of oats.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 257. Short notice, by editor, of paper read before Section F, A. A. A. S., Aug., 1891, at Washington, D. C., giving results of study of disease, showing ability of germ to pass the winter on seed from diseased plant, on volunteer oats, and to limited extent in soil. (D. G. F.)

389. GARMAN, H. **A bacterial disease of cabbages.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 265. Notice of paper read before the Botanical Sec. Am. Asso. Agric. Col. and Ex. Sta., Aug., 1891, in which rotting of cabbage heads is traced to work of bacteria. (See No. 331) (D. G. F.)

390. GRIFFIN, G. W. **Australasian wheat harvest, 1890-'91.** Reports from consuls of United States, No. 128, Washington, May, 1891, pp. 120–128. Refers (p. 127) to rust in wheat. A. N. Pearson, of Victoria, has been experimenting with hybrids to prevent rust, as well as improve the quality of seed in other respects. In Gippsland two varieties and at Port Fairy six varieties have escaped the disease. (J. F. J.)

391. HALSTED, B. D. **A new eggplant disease.** Bull. Torrey Bot. Club, vol. 18, No. 10, Oct., 1891, pp. 302–303. Gives paper read before the Botanical Club of the Am. Asso. Adv. Sci., Washington, Aug., 1891, describing *Phoma solani*, n. sp., as one of the damping-off fungi attacking young eggplants in the hot-bed. Gives account of successful culture of the fungus on agar and sterile portions of healthy stems. Notes in connection as injurious to eggplants, *Phyllosticta hortorum*, Speg., *Botrytis fasicularis*, (Cd.) Sacc., *Gloeosporium melongenæ*, E. & Hals. Noticed in Bot. Gazette, vol. 16, Sept. 15, 1891, p. 261. (D. G. F.)

392. HALSTED, B. D. **A new Nectria.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 257. Short notice of paper read before Section F of A. A. A. S. Aug., 1891, describing stem-rot of sweet potato as caused by a new *Nectria* related to *Nectria Vandæ*, Ward. (D. G. F.)

393. HALSTED, B. D. **Notes upon bacteria of cucurbits.** Bot. Gazette, vol. 16, Sept. 15, 1891, pp. 257, 258. Short notice of paper read before Section F of A. A. A. S., Aug., 1891, giving results of study of disease of melons, squash, and cucumber plants, caused by bacteria. (D. G. F.)

394. HUMPHREY, J. E. **Some diseases of lettuce and cucumbers.** Bull. Mass. State Agric. Ex. Sta., No. 40, Amherst, July, 1891, pp. 2–3. Gives preliminary notice of a destructive disease of lettuce caused by a species of *Polyactis* or *Botrytis* occurring in the greenhouses. Recommends clean culture as the best preventive. Notes presence of *Oidium erysiphoides*, Fries. var. *cucurbitarum*, Auch, upon hothouse cucumbers sent from Fitchburg, Mass., and Ithaca, N. Y. Recommends potassium sulphide 1 oz. in 3 gallons of water, finding 1 oz. per 2 gallons injures foliage. (D. G. F.)

396. JONES, L. R. **A new (?) oat disease.** Fourth Ann. Rept. Vt. Agric. Exper. Sta., Burlington, 1890, p. 139. Reports serious disease of young oat plants in the State, surmising from observation that it was caused by *Fusicladium destruens*, Peck. (See No. 167.) (D. G. F.)

397. JONES, L. R. **Smut on oats.** Fourth Ann. Rep. Vt. Agric. Exper. Sta., Burlington, 1890, pp. 138–139. Reports percentage of smut in experimental plots and fields in 1890 as ranging from a fraction of 1 per cent up to 23 per cent by actual count. (D. G. F.)

398. JONKMAN, Dr. H. F. **Vijanden der koffieplant.** Album der Natuur, Haarlem, 1892, pp. 1–20, 33–49. Treats of the parasites of the coffee plant, especially of *Hemileia vastatrix* and a root nematode. The leaf disease due to the former was first discovered in Ceylon about 1869, and two years later in the south part of British India. In 1877 the blight appeared to such an extent in Ceylon that the coffee product fell from 45,000 to 25,000 kilograms. Since then the product has diminished so greatly that the island can scarcely any longer

be regarded as a coffee-producing country. The disease first appeared in Sumatra in August, 1876. It was discovered in the botanic garden at Buitenzorg in March, 1879. Later it was found to have shown itself generally in Java in 1879–'80. It is not yet known definitely to occur outside of the Indian Ocean region, although a similar sort has been reported from West Africa, and a coffee-leaf disease was reported in 1890 from Central America. (E. F. S.)

399. Kirchner, O. **Braunfleckigkeit der Gerstenblätter.** Zeitschrift für Pflanzenkrankheiten, Bd. 1 Heft 1, Stuttgart, 1891, pp. 24–26, figs. 2. Reports the occurrence of a disease of barley caused by *Helminthosporium gramineum* (Rabenh.) Eriksson, that Eriksson had already reported from Sweden. It causes dark brown spots often over 1 cm. long visible on both sides of the leaf and surrounded by a narrow yellow margin. With the progress of the disease the spots elongate and the leaves wilt and turn yellow. Gives description of the fungus; it was found at Hohenheim, Vorarlberg and in Tirol in 1889 and in and around Hohenheim again in 1890. Did not cause serious damage in that it attacked only the lower leaves. Was not found on other cereals. (W. T. S.)

400. Leathr, J. W. **The smut of onions.** Jour. Roy. Agric. Soc., 3rd ser., vol. 2, London, Sept. 30, 1891, pp. 647–650. Review of a paper by R. Thaxter in Annual Report of the Connecticut Agric. Ex. Sta. for 1889, giving an abstract. (See No. 10.) (M. B. W.)

402. Pammel, L. H. **Fungous diseases of Iowa forage plants.** Monthly review Iowa Weather and Crop Service. Separate, 1891 (?), pp. 33, figs. 15. Deals in more or less popular way, using illustrations from various authors, with the following diseases: (I) Rusts of wheat, barley, oats, Indian corn, clover and apple. (II) Smuts of Indian corn, oats, barley and wheat, with method of treatment. (III) Smuts of timothy, wild rye, tall meadow oat grass, brome grass, *Bromus breviaristatus, Cenchrus tribuloides*, and old witch grass (*Panicum capillare*). (IV) Mildews, *Erysiphe graminis* on various species of grass and *Peronospora graminicola* on *Setaria Italica* and *Setaria viridis; Peronospora trifoliorum* on various species of clover. (V) Ergot. Hosts affected, chemical composition, and a short history of ergotism quoting from work of various authors. (VI) Spot diseases: *Phyllacora graminis*, Pers. on *Agropyrum repens, Elymus Canadensis, Asprella hystrix, Panicum dichotomum; Phyllachora trifolii* on clover. *Phacidium medicaginis*, Lasch, on alfalfa; *Scolecotrichum graminis* on orchard grass. *Helminthosporium graminum*, Rabh., on barley. (VII) Bacterial diseases; sorghum blight, bacterial disease of corn discovered by Burrill. Notes failure of the pure culture from the diseased cornstalks to produce the cornstalk disease of cattle as announced by Billings. (D. G. F.)

403. Prillieux, M. **La pourriture du Cœur de la Betterave.** Bull. Soc. Mycol. France, vol. 7, Paris, Mar. 31, 1891, pp. 15–19, figs. 3. Ascribes the heart rot of the sugar beet to a new fungus, *Phyllosticta tabifica*, which attacks the petioles of the larger leaves. Considers the dark-colored fungi on the central leaves as secondary. (E. A. S.)

404. Prillieux et Delacroix. **A propos du Cercospora apii, parasite sur les feuilles vivantes du Celeri.** Bull. Soc. Mycol. France, vol. 7, Paris, Mar. 31, 1891, pp. 22–23. Notes the injurious presence of *Cercospora apii* in the experimental garden of the "Institute Agronomique," at Joinville-le-pont, and gives the manner of infection. (E. A. S.)

405. Prillieux et Delacroix. **Sur une maladie des Tomatoes produite par le Cladosporium fulvum, Cooke,** Bull. Soc. Mycol. France, vol. 7, Paris, Mar. 31, 1891, pp. 19–21; figs. 3. Describes the effect and external appearance of the fungus. Notes the successful use of sulphur and unsuccessful use of Bordeaux mixture in combating it. (E. A. S.)

406. Reid, Jas. A. **The potato and its blight in Ireland.** Repts. from consuls of U. S., No. 125, Feb., 1891, pp. 182–184. Refers to the destruction of potatoes by *Peronospora infestans*. Explains in a general way the life history of the fungus. The remedies suggested are: (1) Hilling up earth about stalks; (2) cutting off diseased tops; (3) removing and burning rubbish; (4) planting varieties most successful in resisting disease; (5) growing crops under conditions to insure health and vigor; (6) careful selection of seed. (J. F. J.)

407. Russell, Sam'l J. **Linseed in India.** Repts. from consuls of U. S., No. 126, Mar., 1891, pp. 341–344. States (p. 342) that rust is a great enemy of the plant and it always suffers from it in damp seasons. (J. F. J.)

408. Smith, W. G. **Tobacco disease.** Gard. Chron., 3rd ser., vol. 9, No. 216, London, Feb. 14, 1891, p. 211, ½ col., fig. 1. Notes that Prof. Farlow has stated that *Peronospora hyoscyami* has badly attacked *Nicotiana glauca* in Mexico and California. (M. B. W.)

(See also Nos. 482, 483, 484, 485, 486, 487, 489, 507, 553 and 591.)

C.—DISEASES OF FRUITS.

409. Alwood, Wm. B. **A fungous disease upon apple leaves.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 265. Notice of paper read before Bot. Sec. Am. Ass. of Agric. Col. and Ex. Sta., Aug. 13, 1891, giving account, without description, of species of fungous disease of apple, and successful use of weak Bordeaux in its prevention. (See No. 336.) (D. G. F.)

410. Bailey, L. H. **Preservation of trees.** Am. Farm News, vol. 4, No. 7, Aug., 1891, p. 11, 2 cols. Gives abstract of address delivered before N. Y. State Cider and Cider-Vinegar Makers' Association at Albany, N. Y., Jan. 28, 1890 [1891?]. Discusses the failure of the fruit crop in New York State in 1890. Expresses the opinion that the failure was due largely to the action of *Fusicladium dendriticum* and gives formulæ for preparation of ammoniacal solution of copper carbonate, and modified eau celeste. (D. G. F.)

411. Beach, John B. **Lemon scab—Orange blight.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 31, Jacksonville, July 30, 1891, p. 603, 1 col. Cites success of one spraying with sulphate of potash 50 per cent; also successful use of sulphide of lime made by boiling quicklime with flowers of sulphur as preventive of the scab. Thinks blight is advanced condition of black limb. (D. G. F.)

412. Bean, E. **Report of committee on diseases and insects of the Citrus.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, No. 21, May 21, 1891, pp. 409–410. Notes the following diseases with opinions as to their causes; foot rot, leaf blight, rust, black smut and a new disease similar to that on the grapevine attacking the ends of the branches of orange trees. (D. G. F.)

413. Brunk, T. L. **Blackberry rust.** 3d Ann. Rept. Maryland Agric. Ex. Sta., College Park, 1890, pp. 115–116. Gives estimates of per cent of rust, *Cæoma nitens*, Schw., on 20 varieties of blackberries growing on station farm. Concludes Wilson's early, Wilson's junior, Wachusett, early harvest, crystal white, and Thompson's early mammoth as least susceptible to the disease. (D. G. F.)

414. Brunk, T. L. **Strawberries.** 3d Ann. Rept. Maryland Agric. Ex. Sta., College Park, 1890, pp. 104–108. Gives table showing the susceptibility of a large number of varieties of strawberries to the leaf blight (*Sphaerella fragariæ*). Concludes varieties of Bidwell, Van Deman, Anna Forest, Haverland, Hoffman, daisy, ruby, and bubach No. 5 are the five least susceptible varieties situated on the station grounds. Gives résumé of results and recommendations of preventive treatment, quoting from Garman and others. (D. G. F.)

415. [Churchill, George W.] **Some of the most common fungi and insects—with preventives.** Bull. N. Y. Agric. Ex. Sta., new ser., No. 35, Geneva, Aug., 1891. pp. 603–627. Gives reprints from reports of U. S. Dept. of Agriculture describing black rot, downy mildew, anthracnose, powdery mildew, grape leaf blight, white rot, bitter rot of grape, leaf-blight of the strawberry, orange rust, and anthracnose of the raspberry; formulæ for fungicides, methods of applying the remedies, and cost of the treatments. Apple scab, black knot of the plum and cherry, with original notes. (See also 9th Ann. Rept. N. Y. State Agric. Ex. Sta., for 1890, pp. 309–351; Exper. Sta. Rec., vol. 3, Jan. 1892, pp. 403–404.) (D. G. F.)

416. Clark, John W. **Pear or fire blight** (*Micrococcus amylovorus*, Bur.). Bull. Mo. Agric. Col. Ex. Sta., No. 16, Columbia, Nov., 1891, pp. 8–10, diagram. Gives results of experiments in orchard at the college. No remedy but cutting out. Dwarf and standard trees blight equally. (J. F. J.)

417. Cooke, M. C. **Another vine disease** (*Glœosporium pestiferum*, C. & M.). Gard. Chron., 3d ser., vol. 9, No. 212, London, Jan. 17, 1891, p. 82, ½ col. Describes the microscopic characters and injury to the host. The specimens came from Brisbane, Queensland, Australia. (M. B. W.)

418. Detmers, Freda. **Diseases of the raspberry and blackberry.** Bull. Ohio Agric. Ex. Sta., 2d ser., vol. 4, No. 6, Columbus, Oct., 1891, pp. 124–129, pl. 2. Describes the external appearance of the disease caused by the *Glœosporium venetum*, Speg., *Septoria rubi*, Westd., and *Cœoma nitens*, Schw. Refers to note in Hedwigia, 1891, Heft 3, p. 178, by C. A. J. A. Oudemans, who shows the name *Cœoma interstitiale* of Schlechtendal has priority over the old name of *C. nitens*, Schw. Describes the disease of raspberry canes, "which causes wide, dark discolorations of the bark without rupture of any kind," as of bacterial origin. Quotes letter of Burrill to this effect and mentions that cultures of the organism have already been made. (See Ex. Sta. Rec. Washton, vol. 3, Jan., 1892, p. 411.) (D. G. F.)

419. Fairchild, D. G. **Notes on a new and destructive disease of currant canes.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 262. Notice of paper read before Bot. Club of A. A. A. S., Aug., 1891, describing work on the disease, showing it to be caused by peculiar species of fungus as yet unclassified. (J. F. J.)

420. [Galloway, B. T.] **[Black rot, downy mildew, and anthracnose of the grape.]** Circular No. 11, Div. Veg. Path., U. S. Dept. of Agric., 1891, p. 1. A circular containing ten questions, issued to ascertain the per cent of loss from diseases of grapes, and extent of the use of fungicides recommended by the Division. (J. F. J.)

421. Florida Dispatch, Farmer and Fruit Grower. **The cracking of fruit and vegetables.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, Jacksonville, Mar. 19, 1891, pp. 224–225, 2 cols. Review of article by E. S. Goff discussing in popular language the causes of cracking of fruits and vegetables. Mentions *Fusicladium* as cause of cracking of pears. Gives results of experimental demonstration of osmotic action as cause of cracking of ripe apples. (D. G. F.)

422. Halsted, B. D. **Fungi injurious to fruits.** Science, vol. 18, New York, Dec. 18, 1891, pp. 337–338. Extract from paper read before Ohio State Horticultural Society. Advocates keeping plants in good condition and thus enabling them to better resist attacks of fungi. Believes also in rotation of crops, especially root crops attacked by disease. (See also Prairie Farmer, vol. 64, Jan. 30, 1892, ⅔ col.) (J. F. J.)

423. Halsted, B. D. **Experiments for the year upon cranberry diseases.** Rept. N. J. State Board Agric., vol. 18, Trenton, 1891, pp. 266–272. Quotes act passed by legislature of New Jersey to prevent spread of fungous diseases of plants. Refers to occurrence of cranberry-gall fungus (*Synchytrium vaccinii*) and to cranberry scald. Gives results of experiments with fungicides, but con-

cludes that the conditions favoring the scald are to be found in the bog, its soil, water, etc. "The cure for the malady must be in a renovated bog." (J. F. J.)

424. Halsted, B. D. **Papers on fungi injurious to fruits and fungi injurious to garden crops.** Read before the Ohio State Horticultural Society at Zanesville, Ohio. Columbus, December, 1890 (1891), pp. 13. Gives popular account of the various parasitic fungi of fruits and vegetables. (D. G. F.)

425. [Hunn, C. E.] **Diseases of the raspberry.** Bull. N. Y. Agric. Ex. Sta., new ser., No. 36, Geneva, Sept., 1891, p. 641, one-half page. Describes disease and mentions treatment in progress at the station. (D. G. F.)

426. Jones, L. R. **Apple rust and cedar apples.** Fourth Ann. Rept. Vt. Agric. Ex. Sta., Burlington, 1890, p. 139. Reports serious case of rust of apple leaves caused by *Gymnosporangium* sp. *Roestelia* stage, from cedar trees in vicinity of orchard. A simple experiment was undertaken to test the effect of spraying with ammoniacal copper carbonate [1 oz. carbonate in 1 quart ammonia, 22 gallons of water]. Sprayings made May 17 and May 30 after first appearance of jelly-like sori on cedar apples failed to prevent the appearance of the Roestelia upon the apple leaves. (D. G. F.)

427. Jones, L. R.. **Notes upon some other fungous diseases which are prevalent.** Fourth Ann. Rept. Vt. Agric. Ex. Sta., Burlington, 1890, pp. 142–144. Gives notes upon black scab of apple, black scab of pear, pear blight, strawberry leaf blight, currant rust or leaf spot disease (*Septoria ribis*, Desm.), raspberry and blackberry cane rust, ergot, grape mildews, hollyhock rust, mostly of nature of popular description. (D. G. F.)

428. Keller, Rob. **Die amerikanischen Reben und ihre Bedeutung für die europäische Rebenkultur.** Biologisches Centralbl., vol. 11, Nos. 3 and 4, Mar., 1891, Leipzig, pp. 65–74, 97–110. A review of recent literature on the subject, especially of Viala, "Une Mission viticole en Amérique." Mentions resistance of American vines against *Phylloxera*, *Peronospora*, and *Oidium*. Ascribes the weakness of European sorts to their not being adapted to resist the parasites. Sketches the history of *Læstadia Bidwellii*. (W. T. S.)

429. [? Masters, M. T.] **Gooseberry fungus.** Gard. Chron., 3rd ser., vol. 9, No. 232, London, June 20, 1891, p. 770, one-eighth col., fig. 3. Brief note of occurrence with figures of the fungus *Æcidium* and diseased fruit and leaves. (M. B. W.)

430. Pammel, L. H. **A destructive disease of the cherry.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 266. Notice of paper read before Bot. Sec. Am. Asso. Agric. Col. and Ex. Sta., Aug., 1891, describing injurious effects of a species of *Cladosporium*. (See No. 331.) (D. G. F.)

431. Patouillard et Delacroix. **Sur une maladie des dattes produite par le Sterigmatocystis phœnicis, (Corda) Patouill. et Delacr.** Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp. 118–120, pl. 1. Changes *Ustilago phœnicis*, Corda, to the genus *Sterigmatocystis*. Describes the external appearance of the diseased fruits, and gives diagnosis of the species. (E. A. S.)

432. [Peck, C. H.] **Fungi on plums.** Cult. and Country Gent., vol. 56, Albany, May 21, 1891, p. 416, 1 col. Discusses, in answer to inquiry, diseases caused by *Monilia fructigena*, Pers. and *Exoascus pruni*. States hyphæ of the former incapable of penetrating the unruptured epidermis of various fruits. Recommends for *Monilia*, applications of fungicides; for *Exoascus*, application of fertilizers to roots of trees. (D. G. F.)

433. Sheppard, J. **Grapes cracking and scalding.** Gard. Chron., 3d ser., vol. 10, No. 239, London, July 25, 1891, p. 101, 1 col. *Ibid*, Aug. 1, No. 240, p. 138, one-half col. Ascribes the injuries to grapes in greenhouses to changes in temperature and moisture and gives remedy. (M. B. W.)

434. Scribner, F. Lamson. **Some fungous diseases of the grape.** Bull. Agric. Ex. Sta., Univ. of Tenn., vol. 4, No. 4, Knoxville, Oct., 1891 [Dec., 1891], pp. 97–118, figs. 26. Describes black rot of grape, its cause, mycelium, organs of reproduction, parts of vine attacked, conditions favoring disease, treatments, and results. Brown rot with treatment; anthracnose and bird's-eye rot and grape leaf-blight. Refers briefly to general treatment of fungous diseases, the use of powders, liquids, and spraying pumps. (J. F. J.)

435. Viala, Pierre. **Monographie du pourridie des vignes et des arbres fruitiers.** Montpellier, 1891, pp. 120, pl. 7. A thesis presented to the Paris Faculty of Science. Deals principally with *Dematophora necatrix*. See review in this Journal, page 149. (E. A. S.)

436. Viala, Pierre. **Une maladie des greffes boutures.** Rev. Gén. d. Bot., t. 3, No. 28, Paris, April 15, 1891, pp. 145–149, fig. 1. Gives short description of a disease of grape grafts caused by *Sclerotinia Fuckeliana*, which attacks the freshly cut surfaces of grafts when placed in the packing house previous to planting in the nursery. The fungus forms small wrinkled sclerotia upon the cambium of the cut surfaces, which sclerotia, when cultivated, produce both the *Botrytis* and the *Peziza* form; recommends that the sand used as packing for the grafts be spread out in the sun to dry when not in use in the summer time. (D. G. F.)

437. Viala, P., and Boyer, G. **Une nouvelle maladie des raisins.** (*Aureobasidium vitis*, n. sp.) Rev. Gén. d. Bot., t. 3, No. 33, Sept. 15, 1891, pp. 369–371, pl. 1. Describes a new disease of the grape clusters appearing in Bourgogne and Thomery since 1882. The disease is present in wet seasons in the month of September or October upon berries almost mature. The vegetative mycelium fills the whole pulp and sends out through the surface numerous yellow branches which bear on the points of basidia situated at their extremity, oval or cylindrical spores. Creates a new genus for the fungus, *Aureobasidium*. (D. G. F.)

438. Wagner, J. J. **Les principales maladies de la vigne.** Bull. Mens. Soc. Sci. Agric. et Arts, vol. 25, Strasbourg, Feb., 1891, pp. 52–63. Popular account of *Peronospora viticola* and grape anthracnose with treatments. All drawn from one of Prof. Millardet's papers. (E. F. S.)

439. Waite, M. B. **Results from recent investigations in pear blight.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 259. Notice of paper read before section F. of A. A. A. S., Aug., 1891, giving results of study of disease. Finds motile bacillus grows in nectar of pear blossoms and multiplies there as a saprophyte before entering the meristematic tissue. Announces the fact that blight in the nectar is carried from flower to flower by insects. (D. G. F.)

440. Worst, K. **Beiträge zur Brombeerflora des Königreichs Sachsen.** Sitzungsb. und Abh. d. Naturwiss. Gesells. Isis, in Dresden, Jahrg. 1890, Juli bis December, Dresden, 1891, Abh. pp. 50–59. On page 58 a half page is devoted to diseases of *Rubus*. Spot diseases were observed on *R. dumetorum* and *hirtus* produced by *Depazea arcolata*, Fuckel and *Ascochyta rubi*, Lasch. Rust caused by *Phragmidium violaceum*, Schultz was found commonly in fall. Pathological conditions induced by insects and other animals are then noticed. (W. T. S.)

441. Wurtz. **The wine industry of Russia.** Repts. from Consuls of U. S. No. 125, Washington, Feb., 1891, pp. 271–283. Refers to diseases of the vine in various provinces. In Bessarabia they are *Erysiphe tuckeri*, and *Peronospora viticola*. No treatment is given the vines (p. 272). In the region of the Crimea the vines are troubled by *Erysiphe*, *Sphaceloma*, and *Peronospora*. Sulphur is used in combating *Erysiphe* on the southern coast (p. 275). In the region of the Caucasus, *Erysiphe* is common (p. 279). In the government of Kootaris, *Erysiphe* appeared in 1854 and killed about one-fourth of the vineyards and affected the production of others. *Peronospora* and *Sphaceloma* have also

caused great loss (p. 280). In the government of Tiflis the common diseases are *Erysiphe, Peronospora,* and *Sphaceloma* (p. 281). (J. F. J.)

(See also Nos. 342, 348, 424, 453, 455, 456, 459, 461, 468, 469, 470, 476, 507, 509, 511, 549, 632, and 633.)

D.—DISEASES OF FOREST AND SHADE TREES.

442. Anderson, Robert. **The canker of the larch.** Jour. Roy. Agric. Soc., 3d ser., vol. 2, part 3, London, Sept. 30, 1891, pp. 643–644. Discusses treatment advised by Carruthers and thinks cutting out would be successful, but that there is no substitute for the larch. (M. B. W.)

443. Carruthers, J. B. **The canker of the larch.** Jour. Roy. Agric. Soc., 3d ser., vol. 2, part 2, London, June 30, 1891, pp. 299–311, fig. 8. A description of *Dasyscypha Willkommii* (*Peziza Willkommii*) and its injuries to the larch with wood cuts illustrating its microscopic characters and distortions of the host. Discusses the nomenclature, history, and occurrence of the fungus in England. The author differs from Ward in that he thinks the germ tube from the spores is able to penetrate sound bark if young, so that a crack or wound is not necessary for the infection. Bark three or four years old is impervious to the fungus. Suggests keeping the fungus in check by cutting out and burning. (M. B. W.)

444. Masters, M. T. **Larch canker.** Gard. Chron., 3d ser., vol. 10, No. 241, London, 1891, p. 160, 1 col. Review of article in the Journal of the Royal Agricultural Soc. (See No. 443.) (M. B. W.)

445. Mayr, Heinrich. **Die Waldungen von Nordamerika, ihre Holzarten, deren Anbaufähigkeit und forstlicher Werth für Europa im Allgemeinen und Deutschland insbesonders.** München (Riegerische), 1890, pp. 433–434. Enumerates the fungous parasites of forest trees of North America observed in autumns of 1885 and 1887. He includes the following new species. *Puccinidia abietis* n. gen. and n. sp. on *Abies concolor, Gymnosporangium Libocedri* on *Libocedrus decurrens, Chrysomyxa Libocedri* on *Libocedrus decurrens, Æcidium* sp.? on *Fraxinus* sp., *Æ. deformans* on *Pinus mitis, Exoascus quercus-lobatæ* on *Quercus lobata, Sclerotium irritans* on *Chamæcyparis sphæroidea, Rhytisma punctiforme* on *Acer macrophyllum, Lophodermium* (*Hysterium*) *baculiferum* on *Pinus ponderosa, P. resinosa,* and *P. laricio, L. abietis-concoloris* on *Abies concolor, L. infectans* on *Abies concolor, Dothidea betulina* on Birch sp., *Microsphæra* (*Erysiphe*) *corni* on *Cornus florida, Fusicladium* sp.? on *Abies Fraseri, Hysteriopsis acicola* n. gen. and n. sp. on *Picea Sitkæensis.* Includes various other fungi, thirty-four in all, and figures numerous species. Notes effects of *Trametes pini. Podosphæra corni* is figured as a *Microsphæra* and several species are very doubtfully determined. (D. G. F.)

E.—DISEASES OF ORNAMENTAL PLANTS.

446. Halsted, B. D. **An orchid anthracnose.** Garden and Forest, vol. 4, No. 175, New York, July 1, 1891, p. 309. Notes a species of *Glœosporium* on orchids, causing damage in greenhouses. Thinks species distinct from *Glœosporium cinctum,* B. & C., having spores double the latter's size and being straight instead of curved. (D. G. F.)

447. Halsted, B. D. **Hollyhock diseases.** Garden and Forest, vol. 4, No. 189, New York, Oct. 7, 1891, p. 477, ½ col. Enumerates five different fungous diseases of hollyhock: *Cercospora althæina, Puccina malvacearum, Colletrichum malvarum, Phyllosticta althæina,* and *Septoria Fairmani.* (D. G. F.)

448 Halsted, B. D. **Pelargonium blight.** Garden and Forest, vol. 4, No. 187, New York, Sept. 23, 1891, p. 453. Notes, with popular description, a *Colletotrichum* and an *Aschochyta.* (D. G. F.)

449. Halsted, B. D. **Rust of carnations.** Garden and Forest, vol. 4, No. 199, New York, Dec. 16, 1891, p. 596, ½ col. Notes occurrence of *Uromyces caryophyllinus* on carnations received from Philadelphia and gives brief description of its appearance. Concludes that a plant once rusted can not be cured. Thinks with healthy plants the disease may be prevented by spraying with copper salts. (J. F. J.)

450. Kean, Alexander Livingston. **The lily disease in Bermuda.** Technology Quarterly, vol. 3, No. 3, Boston, Aug., 1890, pp. 253–260. Same as No. 6. (D. G. F.)

451. Massee, George. **A primula disease.** Gard. Chron., 3d ser., vol. 10, No. 256, London, Nov. 21, 1891, p. 626, 2 cols., fig. 1. Gives an account of a disease caused by *Ramularia primulæ*, Thüm., with a figure and description of the fungus; finds spores unable to germinate in a 1 per cent solution of copper sulphate. (M. B. W.)

452. Smith, W. G. **Disease of hollyhocks.** Gard. Chron., 3d ser., vol. 9, June 27, 1891, pp. 791–792, 1 col., figs. 2. The writer has obtained the mature fruit of a hollyhock disease caused by *Peziza sclerotiorum*. Gives figures of the fungus. (M. B. W.)

(See also No. 427.)

D.—REMEDIES. PREVENTIVES. APPLIANCES. ETC.

453. Alwood, Wm. B. **Treatment of diseases of the apple.** Southern Planter, 52d year, No. 3, Richmond, March, 1891, pp. 130–131, 3 cols. Gives results of experiment in treatment of apple scab in Virginia, using one early treatment with lye (1 lb. concentrated lye to 10 gallons of water), followed by three later treatments with Bordeaux mixture containing 2, 4, and 6 pounds of copper sulphate; three later treatments with the Masson mixture (copper sulphate and sodium carbonate), 2, 4, and 6 pounds of copper sulphate being used at the three respective treatments; three later treatments with the ammoniacal solution (3 oz. copper carbonate and 1 quart of ammonia 22° Baumé); three later treatments with potassium sulphide (½ oz. sulphide per gallon of water). Although author was not present at harvest gives statement of owner of orchard where experiment was located which points to superiority of the ammoniacal solution as a prevention of the scab. Thinks treatment with lye had good effects. (D. G. F.)

454. Auld, J. McQueen. **Oxide of iron for foot rot.** Fla. Disp., Farmer and Fruit Grower, new ser., vol. 3, Jacksonville, June 11, 1891, p. 463. Records sequence of healthy condition of trees previously attacked by foot rot following application of oxide of iron 5–15 pounds per tree. (D. G. F.)

455. Beucker, George. **Treatment of grape mildew at the school of agriculture at Montpellier, France.** Annals of Horticulture in N. Am. for 1890, New York, 1891, pp. 82–87. Translation by L. H. Bailey of article in *Progrès Agricole* relative to experiment with fungicides in treatment of grape diseases. The author reports a test of the following fungicides: Bordeaux mixture, verdet (dibasicacetate of copper), improved Bordeaux (ordinary Bordeaux with addition of small amount of ammonia), Bordeaux mixture and glue, Masson mixture, (mixture of carbonate of soda and sulphate of copper), gelatinous hydrocarbonate of copper, aluminium mixture, Skawinski's powder, Skawinski's sulphur, cuprosteatite, sulfosteatite, sulfocyanide of copper, sulphated *verdet*, hydrated sulphate of copper, sulphated sulphur, cupro-phosphate, and sulphur with cupro-phosphate. Although the mildew did not make its appearance in the vineyard treated the author discusses at some length the nature of the different fungicides, highly recommending the verdet (dibasicacetate of copper) as the most adhesive copper mixture, remaining upon the leaves until November, last spraying being made July 25. Decides the powders inferior to the liquids, but indicates cuprosteatite as the best powder remedy. (D. G. F.)

456. Boysen, T. H. **Diseases of the grape and their prevention.** Rept. N. J. State Board Agric., Trenton, 1891, pp. 349–357. Describes *Peronospora viticola* as affecting grapes in New Jersey; also black rot. Gives method of prevention, advocating spraying with Bordeaux mixture. (J. F. J.)

457. Brunk, T. L. **Treatment of Cladosporium fulvum.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891, p. 265. Notice of a paper read before the Am. Asso. Agric. Coll. and Exper. Sta., August, 1891, announcing the successful use of carbonate of copper [3 oz. per 50 gallons of water, 1 pound of ammonia]. (D. G. F.)

458. Chester, F. D. **Fungicides.** Bull. Delaware College Agric. Ex. Sta., Special A, Newark, March, 1890, pp. 4. Gives formula for fungicides. Simple sol. sulphate of copper, Bordeaux mixture, modified eau celeste; and directions for treatment of black rot of grapes, pear scab, pear and apple leaf blight, strawberry leaf blight, raspberry and blackberry anthracnose, brown rot of peach and plum, gooseberry mildew, Irish potato blight. (D. G. F.)

459. Chester, F. D. **The leaf blight of the pear and the quince.** Bull. Delaware College Agric. Ex. Sta., Newark, No. 13, July, 1891, pp. 16, pl. 2. Describes disease caused by *Entomosporium maculatum* and gives results of comparative tests of modified eau celeste, Bordeaux mixture, precipitated carbonate of copper, ammoniacal carbonate of copper, carbonate of copper and carbonate of ammonia as preventives of pear leaf-blight. Reports modified eau celeste as giving best results, 85.1 per cent of sound fruit being picked from trees sprayed with it, as opposed to 84.4 for Bordeaux, 80.8 for precipitated carbonate of copper, 78.3 for ammoniated carbonate of copper, 66.3 for carbonate of copper and carbonate of ammonia mixture, and 42.0 for untreated. Records injury to foliage and russet appearance to fruit caused by use of the ammoniated carbonate of copper mixture, and also failure of combined treatment of ammoniated carbonate of copper, and carbonate of copper and carbonate of ammonia mixture to effectually prevent the quince leaf-blight caused by the same fungus. Mentions successful treatment of 1,000 pear trees at Milford, using Bordeaux mixture as preventive of the leaf-blight. (D. G. F.)

460. Cousins, W. W. **Potato blight prevention.** Gard. Chron., 3d ser., vol. 10, No. 254, London, November, 1891, pp. 558–559, 2½ cols. Records a number of successful treatments with Bordeaux mixture for potato blight (*Peronospora infestans?*). (M. B. W.)

461. Craig, John. **Treatment of apple scab, grape and gooseberry mildew.** Bull. Central Ex. Farm, Dept. Agric., Canada, No. 10, Ottawa, April, 1891, pp. 15. After giving an account of losses from the disease, quotes from Galloway and Scribner as to the fungus, *Fusicladium dendritricum*, and also from former's report of experiments in prevention of disease; gives results of experiments in Canada with fungicides as preventive. Concludes from comparative tests of copper carbonate in suspension in water, ammoniacal solution, copper sulphate and ammonia, copper sulphate dissolved in water, and hyposulphite of soda, that the copper carbonate in suspension gave the best results, even exceeding in efficacy the ammoniacal solution; that the copper sulphate, and ammonia and copper sulphate dissolved in water injured the foliage, while the hyposulphite of soda showed no effects because experiment was ruined by leaf crumpler. Gives formulæ for preparation of fungicides and directions for treatment and also method for home preparation of copper carbonate. Discusses treatment of grape mildew (*Peronospora viticola*) and gooseberry mildew. (*Sphærotheca mors-uvæ*, B & C.) (D. G. F.)

462. Degrully, L. **Les approvisionnements pour les traitements contre le mildiou.** Progrès Agricole, 8e ann., Montpellier, Nov. 29, 1891, p. 509, one-eighth page. Refers to treatment of plants with copper preparations, and advises that for 1892 provision be made to treat mildew with sulphate of copper. (J. F. J.)

463. Diller, Isaac R. [Report on the Agriculture, etc., of] Florence, [Italy]. Rep'ts from the consuls of U. S., No. 128, Washington, May, 1891, pp. 34–41. Refers (p. 34) to instructions given by Prof. Ferrari, of the Royal Technical Institute, to the soldiers of the farming class on the following subjects: (1) *Peronospora*, its character, development, damages, and remedies. (2) Treatment and method of applying sulphate of copper. (3) Phylloxera, its character and how to prevent its spread. Over 200 soldiers have attended the lectures, and great interest was manifested. (J. F. J.)

464. Dod, C. Wolley. **Portuguese remedy for vine mildew.** Gard. Chron., 3d ser., vol. 9, No. 210, London, Jan. 3, 1891, p. 23, one-third col. Mentions a patented fungicide containing sulphur, sulphate of copper, and lime in the form of powder, for use against the *Peronospora* of the vine. (M. B. W.)

465. Fairchild, D. G. **Plant diseases.** Ann. of Hort. in N. Am. for 1890, New York, 1891, pp. 76–82. Gives popular account of advances made during the year in the study and prevention of plant diseases. (J. F. J.)

466. Galloway, B. T. **A government spraying device.** Pacific Rural Press, vol. 40, No. 24, San Francisco, Dec. 13, 1890, p. 499, figs. 8. Reprint with figures of article in Journal of Mycology, vol. 6, p. 51. (D. G. F.)

467. Galloway, B. T. **Does it pay to spray?** Pop. Gardening, vol. 6, No. 31, Buffalo, Oct., 1891, p. 266, 1 col. Gives extract of paper read before the Society for the Promotion of Agricultural Science, Aug., 1891, Washington, D. C. Records results of experiments in Virginia in 1891, with following fungicides as preventives of black rot of the grape: Ammoniacal copper carbonate solution, modified eau celeste, precipitated carbonate of copper solution, copper saccharate, copper carbonate and glue mixture, Bordeaux mixture, copper acetate, and copper chloride mixture. Each of the above fungicides contained approximately the same amount of copper as the ammoniacal solution, 0.1 oz. per gallon of water. Reports results of the copper mixture as increasing the yield of perfect fruit from 20 to 50 per cent, while use of several non-cupric mixtures (potassium sulphide, sodium hyposulphite) gave increase of 20 to 38 per cent. Adds result on experiment with full and half strength of Bordeaux mixture, concluding the two mixtures to stand in relation of 96:86 in effectiveness. Reports experiment with pear leaf-blight and scab with same fungicides, in which the copper mixtures apparently slightly injured fruit and foliage. (D. G. F.)

468. Galloway, B. T. **Fungous diseases of the grape and their treatment.** Farmers' Bull., No. 4, U. S. Dept. of Agric., Feb., 1891, pp. 12. Gives a brief description of grape Peronospora, powdery mildew, black rot, and anthracnose. Describes remedies and gives formulæ for making fungicides. Gives methods for treatments and mode of applying fungicides, together with estimated cost of treatments and value of the same. (J. F. J.)

469. Galloway, B. T. **Plant diseases and their treatment.** Southern Planter, 52d year, Richmond, Nos. 10, 11, Oct., Nov., 1891, pp. 548–550, 615–616. Gives paper read before Farmers' Institute at Charlottesville, Va. A popular address. Sketches the rise of study of plant pathology in America, especially work of the Department of Agriculture. Gives formulæ for various fungicides and most approved methods of treatment of black rot, downy mildew, and anthracnose of the grape, potato rot, apple scab, and leaf blight of the pear. Answers numerous queries of audience. (D. G. F.)

470. Galloway, B. T. **Plant diseases and their treatment.** Ann. Rept. N. J. State Board Agric., vol. 18, Trenton, 1891, pp. 73–89, pl. 2, fig. 4. Mentions results of treatment of grapes for black rot and pear seedlings for leaf-blight. Refers to fungicides and spraying apparatus used, giving formulæ and description of apparatus, with instructions as to best methods. Quotes "Yellows" law of Michigan passed in 1881, and briefly describes the disease. (J. F. J.)

471. Galloway, B. T. **Recent progress in the treatment of the diseases of pomaceous fruits.** Garden and Forest, vol. 4, No. 189, New York, Oct. 7, 1891, pp. 478–479. An address before the American Pomological Society, Sept., 1891. Gives résumé of work done for prevention of pear leaf-blight and apple scab. Gives description of two-horse machines for spraying nursery stock, and directions for treatment of nursery stock and apple trees for apple scab. (D. G. F.). See also Scient. Am. Supple., vol. 32, N. Y., Oct. 31, 1891, p. 13205.

472. Galloway, B. T. **Treatment of nursery stock for leaf blight and powdery mildew.** Circular No. 10, Div. of Veg. Path., U. S. Dept. of Agric., 1891, pp. 8, figs. 3. Gives formulæ for preparation of fungicides used in treatment; Bordeaux mixture and ammoniacal solution, with instructions for their use and most approved appliances for their application. (D. G. F.)

473. Goethe, R. **Wirkung des Kupferkalkes gegen pflanzliche und thierische Schädlinge.** Bericht K. Lehranst. für Obst. und Weinbau, für d jahr 1889–'90, Wiesbaden, 1891, pp. 29–30. Refers to a previous paper in the report for 1887–'88. Experiments show that a solution of 2 kg. of copper sulphate and 3 kg. fresh burnt and 4 kg. fresh slacked lime to 100 l. water successfully combat *Fusicladium pyrinum* and *F. dendriticum*, *Erysiphe pannosa* and *Sphærella sentina*, and these can be long held if the trees are sprayed with a solution of half the above strength before flowering and full strength afterwards. *Porthesia chrysorrhœa*, L., and the *Bombyx neustria*, L., become stiff and immovable after eating sprayed leaves. They then pupate. Other insects are enumerated that can be successfully combated with the mixture. (W. T. S.)

474. Green, W. J. **Treatment of raspberry anthracnose.** Bull. Ohio Agric. Ex. Sta., 2nd ser., vol. 4, No. 6, Columbus, Oct., 1891, pp. 119–121. Gives preliminary report on treatment of raspberry anthracnose with weak Bordeaux mixture (copper sulphate 4 lbs., lime 4 lbs., water 50 gallons); thinks results are encouraging, though not to be considered conclusive before a second season. (D. G. F.)

475. Halsted, B. D. **Are fungicides abused?** Garden and Forest, vol. 4 No. 178, New York, July 29, 1891, p. 359, ½ col. Points out the imaginary character of any danger from proper use of fungicides. Replies to Dr. Hoskins's objection by statement that fungicides do not contain arsenic. (D. G. F.)

476. Halstead, B. D. **The cranberry scald.** Garden and Forest, vol. 4, No. 193, Nov. 4, 1891, p. 524. Remarks on the unusual abundance of the scald in New Jersey bogs, and ineffectual use of ordinary fungicides in its prevention. Recommends covering the bogs with thick layer of sand. (D. G. F.)

477. Hickman, J. F. **Treatment of seed to destroy smut germs.** Bull. Ohio Agric. Ex. Sta., 2nd ser., vol. 4, No. 4, Columbus, Aug. 25, 1891, pp. 84–88. Gives results of treatment of wheat for stinking smut or bunt, using various strength of copper sulphate and hot water at varying temperature, after Jensen. Finds the best result obtained from use of hot-water treatment at temperature of 132° to 136° F. and 140° to 144° F. In 5,000 heads from untreated portion, 38 smutted heads were found, while in 5,000 from portions treated with hot water as above none were found. Finds no injury to grains from treatment with copper sulphate 4 oz. per 12 gallons of water. (D. G. F.)

478. High, Geo. M. **Spraying grapes with eau celeste.** Cult. and Country Gent., vol. 56, Albany, Jan. 29, 1891, pp. 88–89, ½ col. Notes successful use of eau celeste in prevention of grape diseases at Middle Bass Island, Lake Erie. Places ratio of yield of sprayed to unsprayed as 2½ to 3 tons to 1 ton or less. Reports 200 acres as being sprayed with solution and gives account of analysis made of grapes sprayed, showing only trace of copper on clusters sprayed 4 times. (D. F. G.)

479. [Hunn, C. E.] **Gooseberry mildew—how prevented.** Bull. N. Y. Agric. Ex. Sta., new ser., No. 36, Geneva, Sept., 1891, pp. 645–646. Gives results of success-

ful treatments of powdery mildew with potassium sulphide, ½ oz. to a gallon of water. (D. G. F.)

480. JONES, L. R. **Black knot of plum and cherry.** Fourth Ann. Rept. Vt. State Agric. Exper. Sta., Burlington, 1890, p. 141. Recommends cutting out and burning all knots as remedy; also advocates State legislation against disease. (D. G. F.)

481. JONES, L. R. **Potato blight and rot.** Bull. Vermont State Ex. Sta., No. 24, Burlington, May, 1891, pp. 19–32, 1 diagram. Records results of an experiment in the treatment of *Phytophthora infestans* by use of Bordeaux mixture. Shows that a single application of the mixture, Aug. 18, after first appearance of the disease, reduced the amount of rotten tubers to15.3 per cent; two treatments, Aug. 18 and Sept. 16 reduced the amount to 9.7 per cent, as opposed to 53 per cent in the untreated portion of the field. Gives cost of the mixture and description for application. Records negative experiment of attempt to disinfect tubers already affected. Concludes that tubers soaked in copper sulphate were more or less injured, as were also tubers soaked in warm water or in a moist oven, while plants from tubers heated to 106°–108° F. in dry oven for 6 to 24 hours were on an average larger than plants from untreated tubers. Gives data showing that the dry rot appears more commonly at stem than at seed end of tuber. (D. G. F.) (See also 4th Rept. Vt. Agric. Ex. Sta., Burlington, 1890, pp. 131–136.)

482. KELLERMAN, W. A. **Corn smut.** Bull. Kansas State Agric. Ex. Sta., Bot. Dept., No. 23, Manhattan, Aug., 1891, pp. 101–104. Gives results of hothouse and field experiment to determine the possibility of artificially infecting young corn plants with smut from sorghum (*Ustilago Reiliana*) and also with corn smut (*Ustilago zea-mays*), which proved entirely negative. Spraying experiments using Bordeaux mixture, iron chloride, and potassium sulphide, did not prove effective in the prevention of the smut. (D. G. F.)

483. KELLERMAN, W. A. **Second report on fungicides for stinking smut of wheat.** Bull. Kansas State Coll. Agric. Ex. Sta., Bot. Dept., No. 21, Aug., 1891, pp. 47–72, pl. 1. Records second series of experiments in prevention of the stinking smut by the use of fungicides in treatment of seed wheat. Calls attention to discrepancy between Jensen's experiments and Kansas experiments, explaining it partially by discovery of inaccuray in thermometer used by the author, and thinks further the difference in estimation of smut may aid in the explanation. Discusses the extra increase in yield caused by the treatments and gives results from treatment of seed for 93 plats with 94 controls. Finds 18 of the treatments destroyed all the smut and gave a yield of grain greater than the average of the two adjacent untreated plats, 29 of the treatments decreased amount of smut to less than 1 per cent and gave yield larger than average of the two untreated plats, while 27 of the treatments injured the seed and 2 entirely killed it. Concludes with directions for use of the Jensen hot-water method, which consists in immersing seed wheat in water at 131° F. for 15 minutes. (D. G. F.)

484. KELLERMAN, W. A. **Smut of oats in 1891.** Bull. Kansas State Agric. Coll. Ex. Sta., Bot. Dept. No. 22, August, 1891, pp. 73–81. Estimates the amount of smut in vicinity of Manhattan, Kans., as varying from 3.2 to 7.92 per cent, in 1891. Gives results of series of experiments to test efficacy of immersing seed in various strengths of solution of potassium sulphide for various periods of time as preventive of the smut. Also test of use of flowers of sulphur. Shows great efficacy of potassium sulphide, recommending formula of 1 pound sulphide in 20 gallons of water, seed to be immersed 24 hours; or 2 pounds sulphide in 20 gallons water, seed to be immersed only 8 to 12 hours. To determine more accurately the extra increase, *i. e.* the increase above that equal to the amount destroyed by the smut, five differ-

ent treatments of hot water and one of potassium sulphide repeated in six different plats were made. The results show an average extra increase of treated over untreated of at least double the amount of that destroyed by smut in the untreated plats. (D. G. F.)

485. KELLERMAN, W. A. **Smuts of sorghum.** Bull Kansas State Agric. Coll. Ex. Sta., Bot. Dept., No. 23, Aug., 1891, pp. 95–101, pl. 3. Distinguishes two species of sorghum smut in Kansas: Grain smut (*Ustilago sorghi* (Link?) Passerini) and head smut (*Ustilago Reiliana*, Kuhn), giving distribution in United States as far as known. Records series of experiments in greenhouse, proving possibility of infection of sorghum plants by infection of seed with spores, and series of field experiments with fungicides, which gave contradictory results. (D. G. F.)

486. KELLERMAN, W. A. **Spraying to prevent wheat rust.** Bull. Kansas State Agric. Ex. Sta., Bot. Dept., No. 22, Aug., 1891, pp. 90–93. Gives result of experiment with several varieties of wheat, barley, and oats to ascertain the value of sulphur, potassium sulphide, iron chloride, and the Bordeaux mixture as fungicides in prevention of the rust. Finds, although the attack of the rust was a violent one, none of the treatments prevented the disease perceptibly, Bordeaux mixture possibly excepted, as giving slightly beneficial results. (D. G. F.)

487. KELLERMAN, W. A. **Test of fungicides to prevent loose smut of wheat.** Bull. Kansas State Agric. Coll. Ex. Sta., Bot. Dept., No. 22, Aug., 1891, pp. 81–90. Reports amount of loose smut of wheat on college farm in 1891 as ranging from 0 per cent to 16 per cent. Gives entirely negative results of use of following chemicals as fungicides in its prevention: Bordeaux mixture, eau céleste, potassium bichromate, copper nitrate, copper sulphate, copper chloride, mercuric chloride, Ward's seed manure, and hot water; 109 plats in experiment. (D. G. F.)

488. KILGORE, B. W. **Combination of arsenites with fungicides.** Bull. North Carolina Agric. Ex. Sta., No. 77 *b*, Technical No. 2, Raleigh, July 1, 1891, pp. 8–11. Gives analyses showing amount of soluble arsenic (As_2O_3) in arsenical mixtures having in solution copperas, copper sulphate, and iron chloride. Finds the injury to the leaves is in direct proportion to the amount of soluble arsenic present in the mixtures and that this amount is increased by the mixing of the above substances with white arsenic, Paris green, or London purple. Shows entire absence of soluble arsenic in mixtures of Paris green or London purple with Bordeaux mixture and records no ill effects to leaves of fig, grape, mulberry, blackberry, peach, pear, and apple from the application of these mixtures. Proportion, 1 pound of arsenite to 100 gallons of mixture. Shows great power of ammonia and sodium carbonate as solvents of arsenites and warns against use of eau céleste with arsenites. (D. G. F.)

489. KINNEY, L. F. **The downy mildew of the potato blight. The Bordeaux mixture as a preventive of the potato blight, experiments with, at this station.** 3d Ann. Rept. R. I. Agric. Ex. Sta., Part II, Providence, Jan., 1891, pp. 137–152 pl. 4. After giving description of disease, copying Scribner, records results of field experiment in its treatment. The experiment was made in field of 30 different varieties of potatoes, and careful estimates of number and weight of tubers from vines sprayed and not sprayed with Bordeaux mixture, formula *b*, show that late potatoes were much more benefited by spraying than were early varieties. Concludes yield of merchantable tubers was increased 9.9 per cent by spraying three times with Bordeaux mixture, due to increase in size of tubers; that percentage of rotted tubers was 150 per cent greater in untreated than treated vines; that the yield of merchantable potatoes was increased 34.5 per cent by five sprayings and the rot decreased, when correction for varieties is made, by 253.3 per cent in number of affected tubers. (D. G. F.)

490. [? MASTERS, M. T.] **American blight and canker.** Gard. Chron., 3d. ser., vol. 9, London, p. 114, $\frac{1}{6}$ col. Gives a formula for a remedy for this disease made up of lime, sulphur, soap, paraffin, boiled oil, and nux vomica. (M. B. W.)

491. [? MASTERS, M. T.] **Apple scab.** Gard. Chron., 3d ser., vol. 9, May 30, 1891, p. 677, $\frac{1}{8}$ col. Note on treatment taken from Bulletin No. 10, Central Expt. Farm, Dept. of Agriculture, Ottawa, Canada. (M. B. W.)

492. [? MASTERS, M. T.] **Bouillie bordelaise and French wines.** Gard. Chron., 3d ser., vol. 9, May 16, 1891, p. 621, $\frac{1}{3}$ col. Refers to report of British consul at Bordeaux, relating to analyses recently made by the Agricricultural Society of Gironde of wines made from grapes treated with Bordeaux mixture, showing them to be quite innocuous. (D. G. F.)

493. [? MASTERS, M. T.] **Carbonate of copper.** Gard. Chron., 3d ser., vol. 9, May 30, 1891, p. 677, 6 lines. Directions for making with copper sulphate and sodium carbonate. (M. B. W.)

494. [? MASTERS, M. T.] **Copper compounds for plant disease.** Gard. Chron., 3d ser., vol. 10, Aug. 15, 1891, p. 196, $\frac{1}{2}$ col. Notices their growing importance in horticulture, and the use of Bordeaux mixture to prevent *Peronospora Schachtii* on the sugar beet. (M. B. W.)

495. [? MASTERS, M. T.] **Copper sulphate as a fungicide.** Gard. Chron., 3d ser., vol. 9, May 30, 1891 p. 678, $\frac{1}{2}$ col. Quotes from Burrill, of the Ill. Agric. Expt. Sta., that the copper compounds are efficient remedies for many plant diseases. (M. B. W.)

496. [? MASTERS, M. T.] **Gooseberry mildew, how prevented.** Gard. Chron., 3d ser., vol. 9, June 6, 1891, p. 708, $\frac{1}{4}$ col. Notes the successful treatment of this disease at the New York Agric. Expt. Sta., Geneva, with potassium sulphide. (M. B. W.)

497. [? MASTERS, M. T.] **Lime as a preservative for potatoes and fruit.** Gard. Chron., 3d ser., vol. 10, Oct. 17, 1891, p. 460, $\frac{1}{4}$ col. States that M. Montclar successfully preserved fruits and potatoes from decay by the use of lime. (M. B. W.)

498. [? MASTERS, M. T.] **Mildew.** Gard. Chron., 3d ser., vol. 9, June 6, 1891, p. 708, $\frac{1}{4}$ col. Review of circular by B. T. Galloway; states that 10,000,000 young fruit trees will be treated this year. (M. B. W.)

499. [? MASTERS, M. T.] **Peach blister.** Gard. Chron., 3d ser., vol. 10, Oct. 24, 1891, p. 491, 4 lines. M. de la Bastie, president of the Pomological Society of France, is said to have prevented this by the use of sulphate of copper. (M. B. W.)

500. [? MASTERS, M. T.] **Potato disease and the Bordeaux mixture.** Gard. Chron., 3d ser., vol. 10, Nov. 21, 1891, p. 617, $\frac{1}{3}$ col. Note stating that the treatment by this means was reported successful to the U. S. Dept. of Agriculture. (M. B. W.)

501. [? MASTERS, M. T.] **Potato experiments.** Gard. Chron., 3d ser., vol. 10, Aug. 1, 1891, p. 137, $\frac{1}{3}$ col. Notes the fact that the Royal Agric. Soc. is carrying on experiments with sulphate of copper to prevent disease of potatoes. (M. B. W.)

502. [? MASTERS, M. T.] **Sulphate of copper and potato disease.** Gard. Chron., 3d ser., vol. 9, May 2, 1891, p. 561, $\frac{1}{4}$ col. Says that there is no question of its efficiency and notes successful experiments at the Conn. Agric. Expt. Sta. (M. B. W.)

503. [? MASTERS, M. T.] **The destruction of blight on plum trees.** Gard. Chron., 3d ser., vol. 10, Nov. 21, 1891, p. 618, $\frac{1}{6}$ col. Gives formula for a mixture to spray on plum trees "to destroy blight and insect pests generally." (M. B. W.)

504. [? MASTERS, M. T.] **The potato disease.** Gard. Chron., 3d ser., vol. 10, July 4, 1891, p. 14, $1\frac{1}{2}$ cols. A warning to potato-growers to be ready to combat the disease on its first appearance. Recommends Bordeaux mixture and other fungicides. (M. B. W.)

505. [? MASTERS, M. T.] **The potato disease.** Gard. Chron., 3d ser., vol. 10, July 11, 1891, p. 47, $\frac{1}{2}$ col. Recommends for treatment Tait's anti-blight, a dry powder. (M. B. W.)

506. [? Masters, M. T.] **The potato disease.** Gard. Chron., 3d ser., vol. 10, Oct. 24, 1891, p. 490, ½ col. States that tubers of potatoes whose foliage had been treated with copper were submitted to chemical analysis, and less than one-hundredth grain of copper per pound was found, the same as in the untreated. (M. B. W.)

507. McCarthy, Gerald. **Plant diseases and how to combat them.** Bull. North Carolina Agric. Ex. Sta., No. 76, Raleigh, Mar., 1891, pp. 20. Gives popular review of what fungi are, general means of prevention, sanitary, etc. Gives formulæ of fungicides, pointing to error in translating value of hectoliter of the French into 22 gall. English measure, instead of 26⅜ gall. U. S. standard. Following mixtures described: Simple solution of copper sulphate, simple solution iron sulphate, Bordeaux mixture, modified eau céleste, Burgundy mixture modified (cop. sulphate, 2½ lbs.; sodium carbonate, 3¾ lbs.; hard soap, one-half lb., water, 22 gallons), ammoniacal solution, Nessler's powder (cop. sulphate, 1 lb.; air-slaked lime, 2 lbs.; road dust or gypsum, 10 lbs.; water, 1 gallon). Discusses spraying machinery, protection afforded by wooden covering to trellises, and the diseases of black rot (*Laestadia Bidwellii*), mildew (*Peronospora viticola*), anthracnose (*Sphaceloma ampelinum*), black knot (*Plowrightia morbosa*), peach rot (*Monilia fructigena*), apple scab (*Fusicladium dendriticum*), pear-leaf blight (*Entomosporium maculatum*), pear fire-blight, peach yellows, potato blight (*Phytophthora infestans*), rust of cereals (*Puccinia graminis*), smut of small grains (*Tilletia fœtens* and *Ustilago segetum*), corn smut (*Ustilago maydis*) ergot (*Claviceps purpurea*). (D. G. F.)

508. McCarthy, Gerald. **Spraying, its value and danger.** Cult. and Country Gent., vol. 56, No. 2000, Albany, June 11, 1891, p. 477, 2 cols. Southern Planter, 52d year, Richmond, Aug., 1891, p. 430. Notice of paper on "copper salts, a possible source of danger" published in Agric. Science, vol. 5, June, 1891, pp. 156–158. See No. 295. (D. G. F.)

509. Pammel, L. H. **Treatment of fungus diseases.** Bull. Iowa Agric. Ex. Sta., No. 13 [Ames], Des Moines, May, 1891, pp. 31–51, figs. 22. Summarizes work upon treatment of black rot of grapes and pear leaf-blight; gives formulæ and cost of fungicides; apparatus for their application. Reports the failure of two sprayings of Bordeaux mixture and one of ammoniacal solution to prevent the apple rust (*Roestelia*) and also the negative results from an experiment in the treatment of plum rust. *Septoria ribis* and *Cercospora angulata* more or less successfully treated with one spraying of Bordeaux and two of ammoniacal solution. Gives results of an experiment in the use of Bordeaux mixture and ammoniacal solution in the treatment of *Cylindrosporium padi*, Karsten (spot disease of cherry.) Brief instructions as to the treatment of apple scab, strawberry leaf-blight, spot disease of the cherry and plum, pear leaf-blight, spot disease of currants, and potato rot. (D. G. F.)

510. Pearson, A. W. **Copper salts and vegetation.** Garden and Forest, vol. 4, No. 191, New York, Oct. 21, 1891, pp. 498–500, 1½ cols. Shows danger of excessive use of copper salts as fungicides, giving results of treatment of Peachblow potatoes continuously with Bordeaux mixture. Finds in treatment of corn with copper sulphate, of potato seed with Bordeaux mixture, and sweet potatoes in the hotbed that their germination was seriously retarded. Sweet potatoes planted in hotbeds following seed previously treated with Bordeaux mixture failed to sprout. Thinks the surface-feeding plants, weeds, etc., in treated vineyards have been affected by the use of the copper fungicides. (D. G. F.)

511. Periam, Jonathan. **Strawberry leaf-blight fungus.** Prairie Farmer, vol. 63, No. 36, Chicago, September 5, 1891, p. 566, one-half col., fig. 1. Gives popular extract from Bull. Ky. Agric. Ex. Sta. See No. 197. (D. G. F.)

512. Petermann, M. **Treatment of potato disease.** Agriculture Science, vol. 5, No. 7, July, 1891, pp. 182–183. Reviewed from Jour. d'Agric. prat., vol. 55, Bruxelles, Jan., 1891, pp. 499–501. Shows effectiveness of Bordeaux mixture (50 kilos

of cryst. copper sulphate, 25 kilos of lime, and 25 hectoliters of water) and mixture of iron sulphate and lime (50 kilos iron sulphate, 25 kilos of lime, 25 hectoliters of water) in treating *Phytophthora infestans*. The Bordeaux mixture gave the most satisfactory results, and the author feels warranted in recommending provisionally the use of the mixture immediately upon appearance of the disease. An analysis of soil and plant sprayed June 21, made Aug. 4, gave no signs of copper. (D. G. F.)

513. Plowright, C. B. **Bordeaux mixture and the potato disease.** Gard. Chron., 3d ser., vol. 10, No. 256, London, Nov. 21, 1891, pp. 609–610, 1½ cols. Describes the experiment of Mr. R. Brown, of Donagmore, Tyrone, in which he disease was successfully treated. (M. B. W.)

514. Plowright, C. B. **Messrs. Sutton & Sons' experiments with Bordeaux mixture.** Gard. Chron., 3d ser., No. 253, vol. 10, Oct. 23, 1891, p. 523, two-thirds col. States that these experiments in treatment of potato blight were unsuccessful and were opposed to the reports from all countries, and asks the question "why?" (M. B. W.)

515. Plowright, C. B. **The Bordeaux mixture; some experiments on the preparation and effects on vegetation of the Bordeaux mixture.** Gard. Chron., 3d ser., vol. 10, No. 255, Nov. 14, 1891, p. 593, 1½ cols. Shows the necessity of having a good quality of fresh lime to decompose all the copper sulphate. (M. B. W.)

516. Powell, Geo. T. **The scare about sprayed grapes.** Cult. and Country Gent., vol. 56, No. 2020, Albany, Oct. 15, 1891, p. 836, 1 col. Refers to hasty action of New York City board of health in condemning grapes sprayed with the Bordeaux mixture. Thinks condemnation was not warranted. (D. G. F.)

517. Scovell, M. A. and Peter, A. M. **Smut.** First Ann. Rept. Ky. Agric. Ex. Sta., Frankfort, 1890, p. 126. Reports prevention of smut by treating wheat with copper sulphate, 10 pounds of sulphate to 8 gallons of water. Seed wheat was immersed in solution and spread on boards to dry. Treatment reported entirely successful. (D. G. F.)

518. Scribner, F. L. **Does it pay to combat plant diseases by spraying?** Orchard and Garden, vol. 13, Little Silver, N. J., Nov., 1891, p. 185, ¼ col. Cites two instances of successful use of Bordeaux mixture, one in which 203 vines were sprayed 8 times to prevent rot, at a total cost of $6.51, saving $32.40 worth of grapes; and a second in which 8,450 vines were treated 7 times and the estimated profit shown by control vines were $1,800. (D. G. F.)

519. [Sorauer, Paul.] **Sulphostéatite cuprique (Kupfervitriol-Speckstein).** Zeitschr. für Pflanzenkrankheiten, Bd. 1, heft. 1, Stuttgart, 1891, p. 49–50. Notice of a circular of Jean Souheur in Antwerp on the cupric sulphosteatite which he introduced in 1890, said to stick very well. Gives account of methods of applying to grapes, tomatoes, and potatoes. (W. T. S.)

520. Stahl, J. M. **Bordeaux mixture for pear leaf-blight.** Cult. and Country Gent. 61st year, Albany, Dec. 31, 1891, p. 1054, 1⅛ cols. Advocates use of Bordeaux mixture as cure for pear leaf-blight. Quotes from various letters giving good results in its use. Gives method adopted. (J. F. J.)

521. Summey, Elmer E. **Shall we protect our apple crop?** Cult. and Country Gent., 61st year, No. 1998, Albany, May 14, 1891, pp. 396–397, 2 cols., figs. 2. Describes methods of spraying orchards recommended by the Department of Agriculture and others to prevent the apple scab; figures pump and bamboo lance. (D. G. F.)

522. Van Slyke, L. L. **Fungicide analysis and valuation.** Cult. and Country Gent., 61st year, No. 2006, Albany, July 9, 1891, p. 556, 2 cols. Gives analyses of commercial copper sulphate, copper carbonate, and Powell's "Copperdine." Shows samples of copper sulphate from the Nichols Chemical Company, New York, contained 99.6 per cent of copper sulphate and samples from various other sources contained from 98.6 to 98.1 per cent of sulphate. Finds in one sample sent from West Park, New York a considerable quantity of free

sulphuric acid. Finds samples of copper carbonate to contain from 62.79 per cent to 88.1 per cent. Shows Powell's "Copperdine," both dry and liquid, does not contain the amount of copper which it purports to. Gives simple tests for purity of copper as complete solution in water, nitric acid, and ammonia. (D. G. F.)

523. Vetch, Robert, & Son. **Potato disease.** Gard. Chron., 3d ser., vol. 10, London, Sept. 17, 1891, p. 344, ⅜ col. Reports successful treatment by copper compounds. (M. B. W.)

524. Washburn, F. L. **Practical work with the codling moth and with a combined insecticide and fungicide.** Bull. No. 10, Oregon Agric. Ex. Sta., Portland, April, 1891, pp. 11–13. Gives formulæ for combined treatment of fungi and insects. (*a*) 10 pounds whale oil soap dissolved in 20 gallons of water; (*b*) 1 pound concentrated lye, 2 pounds sulphur, and 1 gallon of water, heated until thoroughly mixed and dark brown. Add *b* to *a* and then heat for half an hour; add 30 gallons of water, and use at a temperature of 120° F. Gives variable results obtained in experiments with above formula. No control trees left untreated to show actual difference, but author thinks the absence of scab on trees treated 5 times shows efficacy of solution as a fungicide. (D. G. F.)

525. White, J. M. [**Remarks on spraying.**] Rept. N. J. State Board Agric., vol. 18, Trenton, 1891, pp. 102–104. Gives experience in spraying for prevention of fungous diseases and for destroying insects. Advocates using fungicides and insecticides together. (J. F. J.)

526. Willis, J. J. **Prevention of apple scab.** Gard. Chron., 3d ser., vol. 9, No. 214 London Jan. 31, 1891, pp. 149–150, 1¼ col. Review of article by E. S. Goff in 7th Ann. Rep. of the Agric. Expt. Sta. of the Univ. of Wisconsin. (M. B. W.)

(See also Nos. 335, 341, 342, 347, 348, 349, 350, 353, 363, 365, 366, 367, 382, 385, 395, 405, 406, 409, 410, 411, 414, 415, 416, 422, 423, 425, 426, 432, 433, 434, 436, 438, 443, 449, 542, and 560.)

E.—PHYSIOLOGY, BIOLOGY, AND GEOGRAPHICAL DISTRIBUTION.

527. Beyerinck, W. **Sur l'aliment photogène et l'aliment plastique des bactéries lumineuse.** Arch. Néerlandaises, vol. 24, 4me et 5me livr., Haarlem, 1891, pp. 369–442, fig. 1. An important physiological paper. The following topics are discussed: (1) A glance at the species of phosphorescent bacteria known thus far; (2) methods of research; (3) special precautions; (4) the general conditions of nutrition; (5) plastic equivalents among microbes with carbonized peptone; (6) phenomena of extinction caused by photogenic food; (7) photogenic foods and plastic foods of *Photobacterium phosphorescens*. Inactive and antiseptic matters; effect of different substances ont he luminosity and growth *Ph. phosphorescens;* (8) nutrition of *Ph. indicum* and *Ph. luminosum;* (9) theory of the luminous function; (10) does the light of the bacteria possess any biologie significance? (11) applications to the study of enzymes. (E. F. S.)

528. Bourquelot, Em. **Matières sucrées contenues dans les Champignons. 5. Genres Cantharellus, Ad., Russula, Pers., et Hygrophorus, Fr.** Bull. Soc. Mycol., France, vol. 7, No. 1, Paris, Mar. 31, 1891, pp. 50–52. **6. Ascomycetes.** *Ibid.*, No. 2, June 30, 1891, pp. 121–123. **Genre Agaricus, Linné (2e ser.).** *Ibid.*, No. 3, Sept. 30, 1891, pp. 183–192. Notes the presence of mannite in *Cantharellus tubæformis* (Bull.)—young; *Cantharellus cibarius*, Fr.—dried; *Russula Queletii*, Fr.—young, adult; *Russula cyanoxantha*, (Schaeff.)—adult, dried; *Russula adusta*, (Pers.)—young; *Russula nigricans*, (Bull.)—dried; *Hygrophorus hypothejus*, Fr.—young, adult; *Hygrophorus cossus*, (Sowerb.)—young; and the presence of trehalose in *Hygrophorus hypothejus*, Fr.—young. In No. 2, pp. 183–192 notes presence of mannite in *Bulgaria inquinans* (Pers.)—young; *Peziza ochracea*, Bond—adult; *Peziza venosa* (Pers.)—adult; *Acetabula vulgaris* (Fr.)—young, adult,

dried; *Morchella semilibera* (DC.)—adult; *Elaphomyces granulatus* (Fr.)—adult; *Xylaria polymorpha* (Pers.)—dried. In No. 3, pp. 183–192 notes mannite in *Psalliota sylvicola*, Vitt.—young; *Entoloma sinuatum*, Fr.—adult; *Collybia fusipes*, Bull.—adult and dry; *Collybia dryophila*, Bull.—adult; *Clitocybe socialis*, DC.—young; *Tricholoma terreum*, Schaeff.—adult; *Armillaria mellea*, Fl.—young and adult. Trehalose was found in *Hypholoma lachrymabundum*, Fr.—young; *Pholiota mutabilis*, Schaeff.—young and adult; *Hebeloma elatum*, Batsch.—dry; *Pholiota erebia*, Fr.—young; *Pholiota togularis*, Bull.—young; *Collybia fusipes*, Bull.—young and adult; *Collybia dryophila*. Bull.—adult; *Clitocybe laccata*, Scop.—young; *Clitocybe infundibiliformis*, Schaeff.—young; *Tricholoma russula*, Schaeff.—young. (E. A. S.)

529. Bourquelot, Em. **Sur la présence de l'amidon dans un champignon appartenant à la famille des Polyporées le Boletus pachypus, Fr.** Bull. Soc. Mycol., France, vol. 7, No. 3, Paris, September 30, 1891, pp. 155–157. The presence of starch was shown by its reaction with iodine, both in the fungus and when extracted by boiling water, and also by its reaction with diastase. The application of iodine to sections of the fungus shows that the starch ceases at the pores. (E. A. S.)

530. Bourquelot, Em. **Sur la présence & la disparition du tréhalose dans l'Agaric poivré Lactarius piperatus, Scop.** Bull. Soc. Mycol., France, vol. 7, No. 1, Paris, March 31, 1891, pp. 5–9. Shows the presence of trehalose and the absence of mannite in fresh, young specimens of *Lactarius piperatus*, Scop. When the Agaric is either dried or kept in a fresh state for a few hours the trehalose disappears and mannite is found in its place. When, however, the fungus is subjected to the vapor of chloroform the trehalose is retained. (E. A. S.)

531. Bourquelot, Em. **Sur la répartition des matières sucrées dans les différentes parties du Cèpe comestible (Boletus edulis Bull.)** Comptes Rendus, vol. 113. Paris, Nov. 25, 1891, pp. 749–751. After some preliminary observations the author describes his method of analysis and states the grams per kilogram of saccharine matters found in fresh tissue of the various parts as follows:

Stipe.	Tréhalose	24.5	Glucose	0.77
Pileus		13.8		0.71
Hymenium (tubes)		none.		none.

Identical results were obtained with *Boletus aurantiacus*, Bull. The analyses justify the common practice among lovers of Boleti of throwing away the tubes and explains the almost exclusive location of dipterous larvæ in the stipe. In the isolation of trehalose there is a double advantage in using only the stipes. (1) the crystallization is easier and the amount greater and (2) the fatty matter of the spores is avoided. (E. F. S.)

533. Cobelli, Ruggero. **Contribuzione alla Flora micologica della Valle Lagarina.** Verhand. der k. k. Zool. botan. gesell. in Wien, Bd. 41, II, Quartal. Wien, July, 1891, Abh. pp. 581–584. Gives a résumé of the species of fungi reported from Valle Lagarina in two previous lists, viz: Ifunghi della Valle Lagarina Notizie preliminari, in Michelia, 1881, Patavia No. 7; and Elenco sistematico degli Imeno —, Disco —, Gastero —, Mixomyceti e Tuberacei finora trovati nella Valle Lagarina, in VII Publicazione futta per cura del civico Museo di Rovereto. Roverto, 1885. Now adds 53 species, comprising Hymenomycetes, Discomycetes, and Myxomycetes. In the two first mentioned families spore measurements are given of some species. Gives a summary of the fungi now known from Valle Lagarina as follows: Hymenomycetes, 445; Discomycetes, 49; Gastromycetes, 18; Tuberacei, 2; Myxomycetes, 12; total, 526. (W. T. S.)

534. Cooke, M. C. **Spore diffusion in Phalloidei.** Grevillea, vol. 19, London, March, 1891, pp. 84–86. Discusses the dispersion of spores of Phaloidei and Coprini, especially after passing through the stomachs of insects. Shows that there is no evidence that passage through the insect is necessary for the germination of the spore. (M. B. W.)

535. Delacroix, G. **Observations sur quelques espèces peu connues.** Bull. Soc. Mycol., France, vol. 7, No. 2. Paris, June 30, 1891, pp. 111–115. Notes the presence of paraphyses in pycnidia of *Dothiciza populea*, Sacc., *Fusicoccum populinum*, Delacr., *Fusicoccum complanatum*, Dela., *Fusicoccum pini* (Pr.), Sacc., *Stilbospora angustata* (Pers.), Sacc. Concludes that in a certain number of pycnidia or spermogonia the appearance of paraphyses follows the emission of spores, and this is perhaps the first step toward the development of the pycnidia into the ascosporous stage. Notes also the discovery of a new fruiting form of *Stephanome strigosum*, (Wallr.) Sacc., and mentions finding the spermogonia of *Uredo Mulleri*, Schroet. (E. A. S.)

536. D'Istvánffi, Dr. Gy. **Adatok a gombák physiologiai anatomiájához.** (Études rélatives à l'anatomie-physiologique des champignons) Természetrajzi Füzetek, vol. 14. Budapest, 1891 (July 10, 1891), pp. 52–67 (Fr. synopsis, 96–106), pl. 2. In higher plants four systems of tissue are distinguished—meristematic, protective, nutrient, and reproductive. The paper sums up the results of an attempt to trace the four systems in the class of fungi. (E. F. S.)

539. Gaiallard, A. **Les hyphopodies mycéliennes des Meliola.** Bull. Soc. Mycol. France, vol. 7, No. 2. Paris, June 30, 1891, pp. 99–101. Describes the opposite and alternate hyphopodies, and gives the opposite the name of capitate, and the alternate of mucronate hyhopodies. Shows that the former are undeveloped perithecia, and the latter mycelial branches arrested in their development. (E. A. S.)

540. Girard, Alfred. **Observations et experiences sur les champignons parasites de l'Acridium perigrinum.** Comptes Rend., Soc. Biol., new ser., vol. 3, Paris, June 25, 1891, pp. 493–496. Notes the fungus described in No. — as *Polyrhizium leptophyci*, also a similar fungus on different parts of the same insect and having spores arranged as in *Verticillium*. Suggests that this may be another form of the first species, but does not unite them, as there is insufficient evidence. Both are superficial fungi. Finds a white Penicillium, which is undetermined. The author also recounts an infection experiment made by inserting some of the spores of the Isaria of the white worm into the larvæ of the locust. Both the infected and the check larvæ died, but the dead bodies of the former produced a growth of the fungus when kept in a moist place. Keeping the bodies moist is, however, necessary to the appearance of the fungus, indicating that there is little hope of utilizing this Isaria or any other parasite of the same group in combating the locusts of Algeria. There are probably less chances of success with *Entomophthora grylli*, Fresen. (*E. calopteni*, Bessey), as even the few instances of apparent success need further verification. (E. A. S.)

541. Girard, Alfred. **Sur un Isaria, parasite de ver blanc.** Comptes Rend. Soc. Biol., new ser., vol. 3, Paris, April 17, 1891, pp. 236–238. In June, 1890, the author received from Ceauce (Orne) specimens of the "white worm" infested by a parasite, which proved to be an Isaria of doubtful species. It had proved very destructive to the larvæ, spreading so rapidly and killing so many as to decidedly improve vegetation over the areas where the fungus was present. Experiments showed that the spores rapidly communicated the disease to the white worm and to the larvæ of *Tenebrio molitor* both by inoculation and spraying. On artificial media the fungus was easily cultivated, even conquering other fungi that invaded the cultures. The spores retained their germinating power from October until the following March. The culture experiments were made on solid media, but experiments in growing the fungus on liquid media have been undertaken in the hope of facilitating spreading the spores over areas infested with the grubs. (E. A. S.)

542. Halsted, B. D. **Notes on Monilia fructigena and spore germination.** Bot. Gazette, vol. 16, No. 9, Sept., 1891, pp. 266, 267. Notice of paper read before Bot. Sec. Am. Asso. Agric. Col. and Ex. Sta., Aug., 1891, giving account of failure of

spores of *Monilia* to germinate in water in presence of bright metallic copper; also in one part ammoniacal solution of copper of usual strength (3 oz. to 22 gallons of water) to 99 parts of water. Suggests dilution of fungicides. (See No. 331.) (D. G. F.)

543. LINDET, L. **Les produites formés pendant la fermentation alcoolique; leur origine leur influence sur la qualité des boissons fermentées.** Rev. gén. Sci. pure et appli., 2 ann., Paris, November 15, 1891, pp. 720–723. The author mentions the following yeasts: *S. cerevisiæ, ellipsoideus, conglomeratus,* minor Engle, *Marxianus,* levure de Roux, levure caseinse. The following are destitute of endospores, but capable of inducing alcoholic fermentation: *Saccharomyces exigusus-Torula,* levure de Duclaux, *Mucor circinelloides.* Various bacteria inducing the lactic, butyric, and viscous ferments are also found in the vats; also *Mycoderma vini, Bacterium aceti, B. Pastorianum,* and finally such molds as *Botrytis cinera, Penicillum glaucum, Eurotium, Dematium pullulans, Mucor racemosus,* and *M. mucedo.* The yeast is seldom pure. The stronger or more abundant organisms crowd out the weaker. Foreign organisms are likely to reassert themselves toward the close of the fermentation. These intruders may affect both the quantity and the quality of the product. The means of avoiding secondary products is discussed at some length, also the question whether this is desirable. (E. F. S.)

544. MAGNIN, ANT. **Obervations sur le parasitisme et la castration chez les anémones et les euphorbes.** Bull. Scientif. France et Belgique, vol. 23, pt. 2, Paris, August 18, 1891, pp. 412–435, pl. 1, fig. 1. Part I treats of the effect on *Anemone nemorosa* of *Puccinia fusca,* Rehl.; *Urocystis anemones,* Schroet.; *Peronospora pygmæa* Ung.; and *Synchytrium anemones,* (DC.). Wor. The teleutosporic stage of *P. fusca* causes the greatest changes, and always determines a complete castration. Part II treats of the action of the æcidium of *P. fusca* on *A. ranunculoides,* which causes a more or less complete castration manifesting itself in (1) the complete abortion of all the flowers; (2) the abortion of the lateral flowers only; (3) the more or less marked atrophy of the terminal flower, first of the carpels, then of the stamens, and finally of the sepals and the pedicels with virescence and petaloidy, and the production of a sessile staminate flower, like that sometimes observed in certain lateral flowers of healthy plants. Part III treats of the effect of *Uromyces pisi* and other species on *Euphorbia cyparissias;* of *Uromyces scutellatus,* Liv. on *E. verrucosa,* and of *Endophyllum euphorbiæsylvatica,* Wint., on *E. amygdaloides.* In these cases also there is ordinarily a complete castration. The paper contains a number of observations on changes in color and form exclusive of those falling strictly under the title. The author reports a peculiar secretion and a strong mellifluous odor given off by the æcida and spermogonia of *U. pisi* on *E. cyparissias* at certain hours of the day, especially on cloudy mornings. This is similar to the ordinary nectar of the floral organs and attracts insects in the same way. This odor is strong enough to be noticed at some distance and to lead to the discovery of the fungus. M. Lignier, of Caen, has also noticed "une odeur miellée excessivement intense." (E. F. S.)

545. MANGIN, LOUIS. **Sur la désarticulation des conidies chez les Peronosporées.** Bull. Soc. Bot. France, C. R. des Séances, vol. 38, Paris, 1891, pp. 176-184 and 232–236, pl. 1. See review p. 144. (E. F. S.)

546. MANGIN, L. **Revue annuelle de Botanique.** Rev. gén. Sci. pure et appli., 2 ann., Paris, April 30, 1891, pp. 255–266. Reviews Elfving's "Studien uber die einwirkung des Lichtes auf die Pilze," Helsingfors, 1890. (E. F. S.)

548. NORMAN, GEORGE. **Parasitic fungi affecting the higher animals.** Internat. Jour. Micros. and Nat. Sci., third ser. vol. 1, London and New York, July, 1891, pp. 195–204, pl. 2. After preliminary observations and historical remarks the writer treats of *Achorion* producing the disease called *Favus* on mice, dogs, rabbits, cats, fowls, and man, with descriptions and figures of the fungus

and effect on its host. *Trichophyton* is then treated in the same way. It produces the disease called ringworm in man and domestic animals and is often transmitted from animals to man. *Microsporon* is treated briefly. It is rather a rare fungus occurring only in man, producing small brown spots on the skin which do not seriously affect the patient. (M. B. W.)

549. Oberlin. * * * **Viticulture et météorologie en 1890.** Bull. Mens. Soc. Sci. Agric. et Arts, vol. 25, Strasburg, Feb., 1891, pp. 49–52. *Peronospora viticola* appeared in August, following violent rains. It ravaged all the vineyards of Upper Alsace and if some were spared in Lower Alsace, it was not so in Lorraine. This year "this terrible parasite" appeared for the first time on the berries. Another disease of the berries supposed to be black rot appeared, also a disease of the leaves called Rauschbrand or Laubbrand and thought to be distinct from the effects of the *Peronospora*. *Oidium* was rare in 1890, the two diseases requiring different atmospheric conditions. This last statement was denied in the discussion following the reading of the paper. (E. F. S.)

550. Pammel, L. H. **Distribution of some fungi.** Bot. Gazette, vol. 16, No. 9, Sept. 15, 1891., pp. 261–262. Short note on paper read before Bot. Club of A. A. A. S., Aug., 1891. Discussed by L. H. Bailey. (D. G. F.)

551. Patouillard, N. **Remarques sur l'organisation de quelques Champignons exotiques** Bull. Soc. Mycol. France, vol. 7, No. 1, Paris, Mar. 31, 1891, pp. 42–49, pl. 1. Gives notes on the structure and classification of *Michenera artocreas*, Berk. and Curtis, *Emericella variecolor*, Berk. and Br., *Stereum triste*, Berk. and Curt., *Hypocrea impressa*, Mont., *Hypocrea viridans*, Berk. and Curt., *Hypocrea maculæformis*, Berk. and Curt., *Crinula paradox*, Berk and Curt. The first is considered as belonging to the Uredineæ. *Emericella* is said to belong to the Ascomycetes instead of the Basidiomycetes, where it has heretofore been classified. *Stereum triste* represents a sterile form which appears to belong to the genus *Nummularia*. *Hypocrea viridans* has all the characters of the genus *Aschersonia* and should be *A. viridans* (B. and C.) Pat. *Crinula paradox* is identical with *Cronartium asclepiadeum*, Fries, var. *quercuum*, Cooke. (E. A. S.)

552. Planchon, Louis. **Sur un cas d'empoisonnement par l'Amanita citrina, Pers.** Bull. Soc. Mycol., France, vol. 7, Paris, No. 1, Mar. 31, 1891, pp. 54–65. A detailed account by a physician of the poisoning of an entire family from eating *Amanita citrina*. Gives symptoms, treatment, and a description of the fungus. Recommends further study of the subject by physicians, and that colored drawings, together with a description of the effects of the fungus, be widely distributed among those who are unable to distinguish the poisonous and edible mushrooms. (E. A. S.)

553. Smith, J. P. **The potato fungus.** Knowledge, vol. 14, London, July, 1891, pp. 135–137, figs. 4. Popular account giving structure and life history. (M. B. W.)

(See also Nos. 377, 388, 485, 592, 606, and 633.)

F.—MORPHOLOGY AND CLASSIFICATION OF FUNGI.

A.—GENERAL WORKS.

554. Bucknall, Cedric. **Index to Parts I–XIII of "The Fungi of the Bristol District."** Proc. Bristol Nat. Soc., new ser., vol. 6, pt. 3, pp. 425–475. An index by genera and species to 1,431 species of fungi noted in vols. II–VI, new series, followed by an index to plates. (M. B. W.)

555 Cooke, M. C. **Australian Fungi.** Grevillea, vol. 19, No. 91, London, March, June, 1891, pp. 60–62, 89–92. Descriptions of the following new species of fungi: *Trabutia phyllodiæ*, Cke. & Mass.; *Sphærella nubilosa*, *Erinnella lutea*, Phil.;

Ombrophila trachycarpa, Phil.; *Phyllosticta platylobii*, C. & M.; *Glœosporium pestiferum*, Cke. & Mass.; *Marsonia deformans*, Cke. & Mass.; *Agaricus (Leptonia) melanurus*, Cke. & Mass.; *A. (Pholiola) disruptus*, Cke. & Mass.; *A. (Flammula) velluticeps*, Cke. & Mass.; *Boletus (sub-tomentosi) brunneus*, Cke. & Mass.; *Corticium penetrans*, Cke. & Mass.; *Didymosphæria Banksiæ*, on *Banksia; Microthyrium amygdalinum*, Cke. & Mass., on *Eucalyptus amygdalina*; *Coniosporium pterospermum*, Cke. & Mass., on *Lepidospermum*; *Cercospora Kennedyæ*, Cke. & Mass. on *Kennedya prostrata; C. epicocioides*, Cke. & Mass., on *Eucalyptus; Stilbum corallinum*, Cke. & Mass.; *Aposphæria leptospermi*, on *Leptospermum; Dothiorella amygdali; Septoria lepidospermi*, Cke. & Mass., on *Lepidosperma, Melophia phyllachoroidea*, on *Leptospermum lævigatum; Leptostromella eucalypti*, Cke. & Mass., on *Eucalyptus; Glœosporium nigricans*, Cke. & Mass., on *Eucalyptus pauciflora; G. citri*, Cke. & Mass., on branches of lemon.; *G. epicladii*, Cke. & Mass., on *Cladium tatraquetrum; Entyloma eugeniarum*, Cke. & Mass., on *Eugenia*. (M. B. W.)

556. Ellis, J. B., and Everhart, B. M. **New species of fungi from various localities.** Proc. Acad. of Nat. Sci. Phil., Part 1, Phila., Jan. 13, 1891, pp. 76–93. Describes the following species as new: *Phyllosticta lycopodis*, on *Lycopus Canadensis; Ph. petasitidis*, on *Petasites palmata; Ph. minutissima*, on *Acer glabrum; Septoria ptelææ*, on *Ptelea trifoliata; S. nubilosa*, on *Helenium autumnale; Phyllosticta staphylæ*, on *Staphylea trifolia; Phy. rhei*, on *Rheum Rhaponticum; Phyparkinsoniæ*, on *Parkinsonia aculeata; Phy. sophoræ*, on *Sophora speciosa; Cornularia ulmicola*, on *Ulmus; Sphæronema sphæropsoideum*, on *Fraxinus; Schizothyrella hippocastani*, on *Æsculus hippocastanum; Haplosporella seriata*, on *Sambucus; Vermicularia veratrina*, on *Veratrum viride; Sphæropsis ulmicola*, on *Ulmus; Diplodia papillosa*, on *Cornus; D. linderæ*, on *Lindera Benzoin; D. Dearnessii*, on wild *Ribis; Leptostromella elastica*, on *Ficus elastica; Septoria gummigena*, on hardened gum of cherry trees; *S. dolichospora*, on *Solidago latifolia; S. carnea*, on dead leaves of *Carex; S. erechtitis*, on *Erechtites hieracifolia; S. Canadensis*, Ell. & Davis, on *Solidago Canadensis; S. albicans*, on *Saxifraga Pennsylvanica; Phleospora reticulata*, on *Lathyrus palustris; Stagonospora petasitidis*, on *Petasites palmata; St. cyperi*, Ell. & Tracy, on *Cyperus cylindricus; St. trifolii*, on *Trifolium repens; Coryneum paspali*, on *Paspalum patycaule; Glœosporium caryæ*, Ell. & Dearness, on *Carya alba; Gl. celtidis*, on *Celtis occidentalis; Gl. lunatum*, on *Opuntia; Gl. saccharinum*, on *Acer saccharinum; Gl. Canadense*, on *Quercus alba; Gl. ovalisporum*, on *Prunus serotina; Cylindrosporium ziziæ*, on *Zizia cordata; Cy. Dearnessii*, on *Carpinus Americana; Cy. cicutæ*, on *Cicuta maculata; Cy. ceanothi*, on *Ceanothus thyrsiflorus; Marsonia nigricans*, on *Salix; M. apicalis*, on *Salix lucida; Ramularia Canadensis*, on *Carex conoidea; R. stoloṇifera*, on *Cornus stolonifera; R. arnicalis*, on *Arnica cordifolia; R. repens*, on *Aralia racemosa; R. dioscoreæ*, on *Discorea villosa; R. lethalis*, on *Acer rubrum; Peronospora impatientis*, on *Impatiens fulva; Titæa Clarkei*, on *Dichæna strumosa*, growing on *Quercus ilicifolia; Rhinotrichum muricatam*, on decaying bark; *Zygodesmus tuberculosus*, on decaying roots; *Zy. limoniisporus*, on rotten maple; *Coniosporium subgranulosum*, on decorticated poplar; *Fusicladium angelicæ*, on *Angelica atropurpurea; Clasterisporium dothideoides*, on *Shepherdia argentea* and *Artemisia cana; Cercospora kalmiæ*, on *Kalmia latifolia; C. pachyspora*, on *Alisma plantago* and *Peltandra Virginica; C. cæspitosa*, on *Eustachys petræa* and *Chloris Swartziana; C. Davisii*, on *Melilotus alba; C. houstoniæ*, on *Houstonia cærulea; C. osmorrhizæ*, on *Osmorrhiza longistylis; C. acnidæ*, on *Acnida cannabina; C. negundinis*, on *Negundo aceroides; C. senicionis*, on *Senecio aureus; C. infuscans*, on *Rhus venenata; C. comandræ*, Ell. & Dearness, on *Comandra umbellata; C. mikaniæ*, on *Mikania scandens; C. Halstedii*, on *Carya tomentosa; C. medicaginis*, on *Medicago denticulata; C. lathyrina*, on *Lathyrus latifolius; Cercosporella pyrina*,

on *Pyrus coronaria; Fusicladium effusum*, var. *carpineum*, on *Carpinus Americana; Clasterisporium cornigerum*, on *Carpinus* sp.; *Dendryphium muricatum*, on *Prunus Virginiana; D. pachysporum*, on *Peniophora; Septonema griseo-fulvum*, on *Populus tremuloides; Sporidesmium tabacinum*, on *Populus tremuloides; Macrosporium podophylli*, on old *Æcidium podophylli; Helicosporium diplosporum*, on *Smilax; Fusarium volutella*, on *Vitis bipinnata; Epidochium olivaceum*, on *Fraxinus* sp.; *Exosporium sociatum*, on *Rhytisma acerinum*, growing on *Acer rubrum*. (D. G. F.)

557. Farlow, W. G., and Seymour, A. B. **A provisional host index of the fungi of the United States, Part III.** Cambridge, June, 1891, pp. 135–219. Includes in this third and last part the hosts Endogens, Cryptogamia, and animals, together with an addenda of 29 pages and an index of genera. See No. 126 and review, in this Journal, (vol. 7) p. 135. (D. G. F.)

558. Grove, W. B., and Bagnall, J. E. **The fungi of Warwickshire.** (Cont. from Vol. xiii, p. 282.) Midland Naturalist, new ser., vol. 14, Birmingham, Jan., Mar., Apr., May, June, Aug., Sept., Oct., 1891, pp. 20–24, 63–66, 93–95, 115–117, 135–138, 190–192, 209–211, 236–238. A list with habitats and brief notes, including Agaricini, Polyporei, Hydnei, Thelephorei, Clavarei, Tremellinei, Trichogastres, and Nidulariacei. (M. B. W.)

559. Hauer, Dr. Franz Ritter von. **Jahresbericht für 1890.** Annalen des K. K. Natur, Hofmuseums, Band 6, No. 1, Wien, May, 1891, Notiz, 1–87, Section b. Botanische Abtheilung, pp. 23–27. Mentions the placing in the exhibition collection of very large specimens of *Peziza coronaria*, Jacq., *Polyporus frondosus*, and other fungi, lichens, etc. (W. T. S.)

560. Kellerman, W. A. **Parasitic plants.** Cult. and Country Gent., 61st year, No. 2025, Albany, Nov., 1891, p. 936, ½ col. Brief statement of what fungi are and how they attack cultivated plants. Mentions methods of combating diseases. (J. F. J.)

561. Marquand, E. D. **The cryptogamic flora of Kelvedon and its neighborhood, together with a few coast species.** Compiled from the herbarium and notes made by the late E. G. Varenne, M. R. C. S. Essex Naturalist, Chelmsford, April, 1891, pp. 1–30. Contains a list of lichens (208 species) and of fungi (136 species) including Agaracini, Uredineæ, Peronosporeæ, and Erysipheæ; no hosts given for the parasitic forms. (M. B. W.)

562. Massee, George. **New fungi from Madagascar.** Journ. of Bot., vol. 29, No. 337, London, Jan., 1891, p. 1–2, pl. 1. Describes the following new genus and species: *Mycodendron* n. gen., *M. paradoxa, Agaricus* (*Clitocybe*) *pachycephalus, Bulgaria trichophora, Cenangium congestum*, with figures of each. (M. B. W.)

563. Passerini, G. **Diagnosi di funghi nuovi, Nota V.** Atti Reale Accad. Lincei. 4th ser., vol. 7, fasc. 2, 2 Sem., communicazioni pervenuta all 'Accad. sino al 19 luglio 1891, Rome, pp. 43–51. Descriptions of following new species: *Protomyces miscrosporus*, on leaves of *Jasminum sambac; Anthostomella Quercus*, on dry twigs of *Quercus; Laestadia Spartii*, on dead branches of *Spartium junceum*; *Wallrothiella pusilla*, on rotten trunks; *Sphærella alba*, on languishing leaves of *Populus alba*; *Epicymatia Modoniæ*, on *Stilbospora Modonia* on dead branches of *Castanea vesca; Melanopsamma rosæ*, on decayed branches of Rose; *Leptosphæria camphorata*, on dry stems of *Artemisia camphorata; L. faginea*, on dead twigs of Beech; *L. punctiformis*, on decayed stems of *Zea Mays; L. vaginæ*, on decaying sheaths of *Phragmites vulgaris; Melanomma leptosphærioides*, on dry naked stems of *Pulicaria viscosa; M. epileucum*, on old bark of *Ulmus campestris; Massarina microspora*, on dead branches of *Pinus sylvestris; Metasphæria spurca*, on dry umbelliferous stems, perhaps *Daucus Carota; M. clavulata*, on decayed culms of *Scirpus Holoschœnus; Pleosphærulina* gen. n. *P. rosicola*, on dry branches of *Rosa canina; Zignœlla ligustrina*, on dry branches of *Ligustrum vulgare*, together with *Ostropa cinerea; Pleospora verbenicola*, on dry stems of *Verbena officinalis; Curreya ulmicola*, on decayed branches of *Ulmus*

montana; Lophiostoma clavulatum, on dry branches of *Spartium junceum; Ocellaria pulicariæ,* on dry stems of *Pulicaria viscosa; Phoma pulicariæ,* on branchlets of *Pulicaria viscosa; Phyllosticta advena,* on languishing leaves of *Rhamnus corymbosus;* cult. in garden under name of *Guevina Avellana; Ph. ulmaria,* on leaves of *Ulmus campestris; Ph. cinerea,* on languishing leaves of *Populus alba; Phoma cladophilia,* on dead branches of *Elæagnus reflexa; Ph. pycnocephali,* on dead stems of *Carduus pycnocephalus; Ph. lichenis,* on sterile thallus of some lichen, perhaps *Parmelia pulverulenta,* on branches of *Fraxinus; Macrophoma cylindrica,* on dead branchlets of *Pulicaria viscosa; Aposphæria leptosphærioides,* on dead stems of *Pulicaria viscosa; Coniothyrium tuberculariæ,* on sporodochia of a species of Tubercularia on branches of *Calycanthus præcox; Diplodia carpogena,* on decaying pericarp of *Æsculus Hip, pocastanum; D. rhodophila,* on dry branches of cultivated rose; *D. microsporella,* Sacc., var. *cordiæ,* on dead branchlets of *Cordia Myxa; D. australis,* on dead branchlets of *Celtis australis; D. emphisphærioides,* on oak bark; *Botryodiplodia æsculina,* on dead branches of *Æsculus Hippocastanum; Ascochyta decipiens,* on stems and branches of *Antirrhinum majus; Hendersonia subcorticia,* on detached and still hanging bark of *Pirus malus; H. candida,* on languishing leaves of *Populus alba; Dichomera persicæ,* on cut off stump of peach; *Rhabdospora jasmini,* on frozen branches of *Jasmium officinalis; Rh. lagerstroamiæ,* on denuded dry branches of *Lagerstræmia Indica; Rh. muhlembeckiæ,* on branches of *Muhlembeckia complexa; Pleococcum Holoschoeni,* on dead stems of *Scirpus Holoschoenus; Gloeosporium cerei,* on *Cereus triangularis; Pestalozzia* (*Pestalozziana,* sub gen. nov.) *artemisiæ,* on dry stems of *Artemisia camphorata; Coniothecium cupulariæ,* on dry stems of *Inula viscosa; Speira ulicis,* on dry branches of *Ulex Europæus; Tubercularia calycanthi,* on dead branches of *Calycanthus præcox; T. rhodophyla* [sic.], on dead branches of cultivated rose; *Fusarium robiniæ,* on fallen branch of *Robinia pseudacacia; F. celtidis,* on dead branches of *Celtis australis; Chætostroma Holoschoeni,* on decayed leaves of *Scirpus Holoschoenus.* (W. T. S.)

564. Peck, Charles H. **Annual report of the state botanist of the state of New York.** 44th Report N. Y. State Mus. Nat. Hist., Albany, 1891, pp. 75, l. 4, pl. 4. Contains descriptions of many new species of fungi both by himself and Mary E. Banning. The last are in a manuscript volume of the Fungi of Maryland, illustrated by colored plates. The genus Tricholoma of New York is monographed in the same manner as genera in previous reports. For notice see under head of Reviews; this Journal, (vol. 7) p. 147. (J. F. J.)

565. Saccardo, P. A. **Sur les règles à suivre dans la description des espèces végétales et surtout des cryptogames.** Bull. Soc. Mycol., France, vol. 7, Paris, June 30, 1891, pp. 73–75. Gives a digest of rules to be used in describing fungi. They relate to modes of expression, language, citation of authority, writing of measurement, expression of scientific names, standard of colors, and names for the fruit of different groups. (E. A. S.)

566. Somers, J. **Nova Scotian fungi.** Proc. and Trans. Nova Scotian Inst. Nat. Sci., vol. 7, pt. 4, Halifax, 1890, issued 1891, pp. 464–466. Contains enumeration of fungi of Nova Scotia begun in vol. 7, part 1, p. 18 of Transactions. Gives 16 species, none new. (D. G. F.)

See also No. 644.

B.—CHYTRIDIACEÆ.

567. Fischer, Dr. Alfred. **Phycomycetes.** Rabenhorst's Kryptogamen-Flora, Band I, Abth. IV, Pilze: Lief. 45, 46, 47. Leipzig, 1892 (1891), pp. 1–192, many figs. See review this journal, (vol. 7) p. 135. (E. F. S).

See also Nos. 371, 423, 544.

C.—OÖMYCETES.

568. HALSTED, B. D. **Notes upon Peronosporeæ for 1891.** Bot. Gaz., vol. 16, No. 12, Dec. 15, 1891, pp. 338-340. Gives notes on the following species: *Phytophthora infestans, Sclerospora graminicola, Plasmopara viticola, Plasmopara pygmæa, Plasmopara geranii, Bremia lactucæ, Peronospora parasitica, Peronospora Cubensis, Peronospora effusa, P. potentillæ, Cystopus Ipomœ panduratæ* [sic.], *C. candidus, C. portulacæ.* Notes *Alyssum maritimum* as new host for *P. parasitica;* and *Potentilla grandiflora* as new host to the country for *P. potentillæ.* (D. G. F.)

569. MASSALONGO, C. **Sull' alterazione di colore dei fiori dell' Amarantus retroflexus infetti dalle oospore di Cystopus Bliti, D'By.** Nuovo Giorn. Bot. Ital., vol. 23, No. 1, Firenze, 8 gennaio 1891, pp. 165-167. Records the finding of oöspores of *Cystopus bliti* D'By. in inflorescenses of *Amarantus retroflexus.* The flowers attacked assume a more or less pronounced red color and are thus rendered more conspicuous. The author suggests that the oöspores formed in these reddish flowers are perhaps distributed by animals, while those occuring as usual in leaves are distributed by the wind; suggests also that here is an analogy to heterocarpism in higher plants, except that the difference between the oöspores is not a morphological one, but simply one of different comportment in regard to the organs of the host plant attacked. (W. T. S.)

570. SPEGAZZINI, CAROLUS. **Phycomyceteæ Argentinæ.** Revista Argentina de Hist. Nat., vol. 1, Buenos Aires, Feb., 1891, pp. 28–38. Gives list of species of Phycomycetes, and describes new species as follows: *Mucor mucedo* var. *a b, M. platensis, Cystopus platensis,* on leaves of *Bœrhaavia hirsuta, Chlospora* n. gen., *C. vastatrix,* in bulbs of *Allium coepæ; Peronospora nicotianæ,* on leaves of *Nicotiana longiflora.* The species in the list, 37 in all, are accompanied by notes on hosts, measurements of spores, etc. (J. F. J.)

(See also Nos. 371, 377, 545, and 567.)

D.—ZYGOMYCETES.

(See Nos. 543, 567 and 570.)

E.—BASIDIOMYCETES.

571. ALLEN, A. and SPIERS, W. **British Agaricini.** Internat. Jour. Micros., and Nat. Sci., 3d ser., vol. 1, London and New York, Aug., 1891, p. 233, 7 lines. Notes that there are 1,400 species in the British Isles, 134 edible and 30 poisonous. (M. B. W.)

572 COOKE, M. C. **Additions to Dædalea.** Grevillea, vol. 19, No. 92, London, June, 1891, pp. 92–93. Descriptions of five new species of *Dædalea* from Herb. Berk., *D. Eatoni,* Berk., *D. subcongenor,* Berk., *D. flabellum,* Berk., *D. Andamanni,* Berk., *D. Mulleri,* Berk. (M. B. W.)

573. COOKE, M. C. **Additions to Merulius.** Grevillea, vol. 19, June, 1891, p. 108–109. Describes as new *Merulius sordidus,* B. & C., *M. rimosus,* Berk. in herb., *M. pelliculosus,* and states that *M. pallens,* Schwein. (not of Berkeley), is the same as *M. corinum*; and *M. terrestris,* B. & Br. (undescribed), is the same as *M. brassicæfolius.* (M. B. W.)

574. COOKE, M, C. **A new subgenus of Agaricus.** Grevillea, vol. 19, June, 1891, pp. 104–105. Describes the new subgenus *Metraria* founded on a species from Australia, which is also described; *Agaricus* (*Metraria*) *insignis,* C. & M. (M. B. W.)

575. COOKE, M. C. **British Thelephorei.** Grevillea, vol. 19, March, 1891, pp. 64–67. Synopsis of the genus *Stereum* with descriptions of the species. (M. B. W.)

576. Cooke, M. C. **Favolus and Laschia.** Grevillea, vol. 19, No. 92, London, June, 1891, p. 105. Original description of the following species from herb. Berkeley. *Favolus subgelatinosus*, Berk., *Laschia decurrens*, Berk. & C., *L. flabellula*, B. & C. in herb., *L. lurida*, Cesati, in Myct. Bon., *Glavosporus corrugatus*, Berk. (M. B. W.)

577. Cooke, M. C. **Irpex addenda.** Grevilea, vol. 19, No. 92, London, p. 109. Describes the following new species: *Ipex decurrens*, Berk. in herb., *I. crispatus*, Berk. in herb., *I. modestus*, Berk., in herb., *I. clathratus*, Berk. in herb., *I. decolorans*, B. &. C. in herb. (M. B. W.)

578. Cooke, M. C. **Lachnocladium.** Grevillea, vol. 19, No. 92, London, p. 93. Note on affinities. (M. B. W.)

579. Cooke, M. C. **Some omitted diagnoses.** Grevillea, vol. 19, No. 92, London, pp. 103–104. Description of fungi omitted from Saccardo's Sylloge: *Agaricus* (*Innocybe*) *holophlebius*, Berk., in herb., *Thelophora griseozonata*, Cke. Rav. Fun. Amer. No. 444. (M. B. W.)

580. Cooke, C. M. **Species of Hydnei. Additimenta to Saccardo's Sylloge.** Grevillea, vol. 20, No. 93. Sept., 1891, pp. 1–2. Describes the following new species: *Hydnuum peroxydatum*, Berk., *H. analogum*, Berk. in herb., *H. cohærens*, B. & C., *H. scariosum*, B. & Br., *H. lachnodontium*, Berk., *H. Liriodendri*, B. & C. in herb., *H. artocreas*, B. & C. in herb., *H. Agressii*, Berk. in herb. with notes on *H. microdon*, Pers., *H. Berkeleyi*, Curtis, *H. alliceps*, Berk. & Rav., *H. herbicolum*, Ellis, *H. trechodontium*, Berk., and states that *H. luteo-virens* appears to be an *Irpex*. Eight species of *Radulum* are mentioned; *R. Emerici*, Berk. and *R. Neilgherrensis*, Berk. in herb., are described. Five species of *Phlebia* are mentioned, of which *P. spilomea*, Berk. & Curt., and *P. deglubens*, Berk. and Curt., are described. *Odontia albominiata*, B. & C., is said to be *Hydnum cinnabarinum*, Schwein., and *O. scopinella*, Berk., not a *Hydnum*, as described in Sacc. Syll. *Kneiffia tinctor*, Berk. in herb., and *K. subtilis*, Berk, in herb., are described as new, and *K. typhæ*, Berk. in herb., said to be *Corticium typhæ*. (M. B. W.)

581. Cooke, M. C. **Trametes and its allies.** Grevillea, vol. 19, No. 92, June, 1891, pp. 98–103. Divides the genus as treated in Saccardo's Sylloge into sections, giving a list of the species in each; five species have been transferred to the genus *Sclerodepsis* in a previous number. The following are described for the first time: *Trametes Dickinsii*, Berk. in herb., *T. gausapata*, Berk. and Rav. in herb. *T. Burchelli*, Berk. in herb., *T. adelphica*, *Hexagonia laevis*, Berk. in herb., *Hexagonia tenius*, Hook. var. *subtenuis*, Berk. in herb. (M. B. W.)

582. Cooke, M. C. **Two Australian fungi.** Grevillea, vol. 19, No. 91, Mar. 1891, pp. 81–83). Describes as new *Agaricus* (*Amanita*) *strobilaceus* and *Lasiosphæria lævaespora*, Cke. and Mass. (M. B. W.)

583. Cooke, M. C. **Two Japanese edible fungi.** Grevillea, vol. 19, No. 91, Mar., 1891, pp. 62–64. Reprints an article by Mr. N. Tanaka in the Botanical Magazine of Japan, in which two new species of *Lactarius* are described, *L. Hatsudake* and *L. Akahatsu*. (M. B. W.)

584. [Crane, D. C.] **Growing mushrooms in winter.** Rept. N. J. State Board Agric., vol. 18, Trenton, 1891, pp. 478–479. Refers to experiments of a farmer near Elizabeth, N. J., in raising mushrooms, describing the hotbed. No results mentioned. (J. F. J.)

585. De Seynes, J. **Conidies de l'Hydnum coralloïdes, Scop.** Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp. 76–80, figs. 8. Describes conidia of *Hydnum coralloïdes*, Scop., and compares them with the normal tetraspores, and with conidia of *Hydnum erinaceus*, Bull., and *Polyporus biennis*, Bull. The conidia are endocellular and of two kinds. (E. A. S.)

586. Florida Agriculturist. **Underground oranges.** Fla. Agriculturist, vol. 18, No. 47, De Land, Dec. 2, 1891, p. 651. Notes determination of peculiar underground bulbs resembling oranges as really *Phallus impudicus*. (D. G. F.)

587. Godfrin, J. **Contributions à la flore mycologique des environs de Nancy.** Catalogue méthodique des Champignons Basidiés récoltes en 1889–'90. Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp.124–136. A catalogue of 160 Hymenomycetes. (E. A. S.)

588. Hennings P. **Note micologiche.** Malpighia, anno V. fasc. 1–2, Genova, 1891, pp. 89. Part I consists of following corrections of some errors regarding some *Polyporeæ* collected by Balansa in 1884 in Paraguay, and for the most part described as new by Spegazzini. *Hexagona Friesiana*, Speg., F. guar. Pug. I. p., 55 = *Polyporus umbonatus*, Fr., *Thelophora (Craterellus) spassoides*, Speg., l. c., p. 69 = *Polyporus Warmingii*, Berk., *Polyporussub tropicalis*, Speg., = *P. gilvus*, Fr., *P. subgilvus* Speg., = *P. gilvus*, Fr., *P. Landii*, Fr., = *P. occidentalis*, Kalch., *P. Drummondii*, Klotzsch forma *setulosa* Speg., = *P. versatilis*, Berk. In part II. of the paper the following new species and varieties are described: *Æcidium Aschersonianum*, on leaves of *Kundmannia sicula* from Malta; *Uromyces Schweinfurthii*, on branches of *Acacia Ehrenbergianæ* from Arabia Felix; *Schroeteria Cissi*, (DC.) De T., var. *Arabica*, on petioles and branches of *Cissus quadrangularis* from Arabia Felix. (W. T. S.)

589. Massee, George. **New or imperfectly known Gastromycetes.** Grevillea, vol. 19, No. 92, London, June, 1891, pp. 94–98. Describes the following new species and new genera. *Mutinus fraxinus*, Berk. in herb. *Crucibulum simile*, *Tulostoma Wrightii*, Berk. in herb. *T. album*, *Hydnangium Tasmanicum*, Kalchbr. in herb. *Secotium leucocephalum*, *S. Gunnii*, Berk. in herb. *Gyrophragmium Texense* (B. & C.), Mass., *Calostoma æruginosa*, *Protoglossum*, nov. gen., *P. luteum*, *Gymnoglossum*, nov. gen. *G. stipitatum*. (M. B. W.)

590. [?Masters, M. T.] **Mushrooms.** Gard. Chron., 3d ser., vol. 10, London, September 26, 1891, p. 368, one-half col. Describes a method of culture. (M. B. W.)

591. Olivier, Ernest. **Les ronds de sorciers.** Rev. scientif., Bourbonnais, 4e ann., Moulins, August 15, 1891, p. 170. Describes the appearance of sorcerers rings in meadows in June. These often persist several years, and increase in size to the vexation of the farmer. The grass in the interior of the ring is yellow, but that on the exterior, over a breadth of 20–30 centimeters, is always remarkably green and vigorous. These rings are due to *Agaricus campestris*, etc. (E. F. S.)

592. Patouillard, N. **Polyporus bambusinus, noveau polypore conidifère.** Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp. 101–103. Describes the new species, *Polyporus bambusinus* under three forms dimidiate, nodulose, and resupinate. The first and third have a conidial fructification, and neither normal basidia nor cystidia can be found in the resupinate form. (E. A. S.)

593. Rolland, Léon. **Essai d'un calendrier des Champignons comestibles des environs de Paris.** Bul. Soc. Mycol. France, vol. 7, Paris, March 31, 1891, pp. 10–14, pl. 2. Describes external appearance, and gives habitat and date of *Paxillous involutus*, (Batsch) Fr., *Lepiota procera*, Scop. *Lactarius volemus*, Fr. *Lactarius deliciosus*, (L.) Fr. *Lactarius rufus*, (Scop.) Fr. (E. A. S.)

594. Rolland, Léon. **Excursions mycologiques dans les Pyrénées et les Alpes-Maritimes.** Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp.84–97. Gives lists of fungi collected at Cauterets and in the province of Var on the shores of the gulf Juan. The following new species are described: *Omphalina bibula*-Cuel., var. *citricolor; Tricholoma saponaceum*, var. *lavedana.; Blitrydium carestiæ*, de Not, *Ceratostoma phœnicis*. (E. A. S.)

595. Rolland, Léon. **Une visite au Musée Barla.** Bull. Soc. Mycol. France, vol. 7, Paris, March 31, 1891, pp. 66–72. Describes M. Barla's collection of plaster casts of fleshy fungi at Nice, and gives a catalogue of a large number of the species modeled. In a footnote are given detailed directions for making the models. (E. A. S.)

596. Smith, J. P. **The mushroom.** Knowledge, vol. 14, 73, London, November 2, 1891, figs. 6. A popular account of *Agaricus campestris*, with description of its anatomy and life history. (M. B. W.)

597. Speggazini, Carolo. **Fungi guaranitici nonnulli novi v. critici.** Revista Argentina Hist. Nat., vol. 1, Buenos Aires, April, 1891; pp. 101–111, June, 1891, pp. 168–177. Notes on Hymenomycetes describing the following new species: *Marasmius balansæ, Poria subargentea, Favolus elegantissimus, F. dædaleoides, F. Harioti, Pterula humilis.* The species, 31 in all, are accompanied by notes and diagnostic characters. Part 2 mentions various species of Hymenomycetes, Gastromycetes, Myxomycetes and Hyperdermeae. The following are described as new species: *Lanopila guaranitica, Ustilago juncicola* in ovaries of *Juncus Chamissoni, Entyloma nectrioides* on leaves of a species of *Leguminosæ, Puccinia chloridis* on leaves of *Chloriis* sp., *P. macrocephala* on leaves of *Convolvulaceæ, Uromyces ? cyperinus* on leaves of *Cyperaceæ, U. æruginosus* on leaves of *Sapindaceæ* (?), *Uredo carnosa* on leaves of *Orchidaceæ.* Notes are given on other species. (J. F. J.)

598. Taylor, Thomas. **Mushrooms of the United States.** U. S. Dept. Agric., Rept. for 1890, pp. 366–373, pl. 5. Gives colored figures of eight edible and twelve poisonous mushrooms. Gives directions for the culture of various species, with figures of houses and beds for their cultivation. Also various recipes for their preparation for the table. Issued as a reprint with the title "Food Products; eight edible and twelve poisonous mushrooms of the United States, with directions for the culture and culinary preparation of the edible species." pp. 16, pls. 5. (D. G. F.)

599. Zopf, W. **Ueber die Flora und die Vegetation Spitzbergens—3 Thallophyten.** Naturwissens. Wochenschr., vol. 6, Berlin, Dec. 13, 1891, p. 508. Notes the occurrence of *Lycoperdon furfuraceum,* Schaeff. (J. F. J.)

(See also Nos. 334, 336, 337, 445, 528, 529, 530, 531, 562, 614, and 637.)

F.—URED INEÆ.

600. Arthur, J. C. **Notes on Uredineæ.** Bot. Gazette, vol. 16, No. 8, Aug. 15, 1891, pp. 225–227. Discusses synonomy of *Puccinia stipæ,* considering the publication of the species in 1884 by the author as prior to collection by Hora of the identical species named by Opiz in 1852. Prefers *Puccinia stipæ* (Opiz) Arthur, as correct writing of the name. Draws attention to the name *Puccinia ornata,* Harkness, as being preoccupied, and suggests the name *P. medusæoides.* [It may be remarked, however, that Harkness's species, *P. ornata* was previously described by Winter as *P. appendiculata* on Bignoniaceous plant from Mexico. See Sacc. Sylloge, vol. 7, part 2, p. 727, No. 2552.] Points out an error in the measurement of the teleutospores of *Uromyces perigynius,* Halsted, making their true dimensions 12–18 x 24–30*v.* Mentions work of Dietel in Hedwigia, vol. 28 (1889), p. 22, demonstrating *Uromyces caricis,* Peck, to be the uredo of *Puccinia caricis-strictæ,* Dietl. Reports the discovery of the uredospores of *Uromyces perigynius* and teleutospores of *Coleosporium viburni.* Describes *Puccinia cyperi* n. sp. on *Cyperus Schweinitzii,* and *C. strigosus; Uromyces gentianæ* n. sp. on *Gentiana quinquefolia* var. *occidentalis.* (D. G. F.)

601. Atkinson, Geo. F. **A new Ravenelia from Alabama.** Bot. Gazette, vol. 16, No. 11, Nov., 1891, pp. 313–314. Describes as new *Ravenelia cassiæcola,* upon stems, leaves and pods of *Cassia nictitans.* Considered specifically distinct from *R. stictica,* Berk. & Br., No. 554, Myc. Univ., *R. glandulæformis,* Berk. & Curt., No. 1251, Myc. Univ., and *R. texanus,* Ell. & Galw. (D. G. F.)

602. Cockerell, T. D. A. **Additions to the fauna and flora of Jamaica.** Jour. Insti. Jamaica, vol. 1, Kingston, Nov., 1891, p. 32. *Uredo Vialæ,* Lagerheim, on vine leaves, is reported from near Rockport. (E. F. S.)

603. Graziana, A. **Deux champignons parasites des feuilles de coca.** Bull. Soc. Mycol. France. vol. 7, Paris, Sept. 30, 1891, pp. 152–153, pl. 1. Describes *Uredo erythro-*

xylonis on *Erythroxylon coca* from Peru and Bolivia, and *Phyllosticta erythroxylonis* on the same host from Bolivia. (E. A. S.)

(See also, Nos. 401, 402, 418, 445, 544, 588, and 597.)

G.—USTILAGINEÆ.

(See Nos. 402, 558 and 597.)

H.—ASCOMYCETES.

I.—*Gymnoasci.*

(See No. 432, 445.)

II.—*Perisporiaceæ.*

604. CHATIN, A. **Contribution à l'histoire botanique de la truffe, Kammé de Damas (Terfezia Claveryi).** Comptes Rendus, vol. 113, Paris, Sept. 14, 1891, pp. 381–384. The author had previously described a var. *arabica* of *T. boudieri*, and now finds a new species which is widely distributed. It is a remarkable species and represents the type of the section characterized by reticulate and non-verrucose spores. The weight of the tubers averages 50 to 130 grams. (E. F. S.)

605. CHATIN, A. **Contribution à l'histoire botanique de la truffe (Quatrième note)—Kamés de Bagdad (Terfezia Hafizi et Terfezia Metaxasi) et de Smyrne (Terfezia leonis).** Comptes Rendus, vol. 113, Paris, Oct. 26, 1891, pp. 530–534. As in case of the Terfaz of Algeria, the kamé of Smyrna is eaten mixed with meat and eggs and cooked in butter or oil. A study of the immature spores of this species shows that *T. boudieri* is distinct, and not an immature form of *T. leonis*, as Tulasne conjectured. The latter occurs also in Sicily, near Naples, and in Spain. (E. F. S.)

606. CHATIN, A. **Contribution à l'histoire naturelle de la truffe—Parallèle entre les Terfaz ou Kamés (Terfezia Tirmania) d'Afrique et d'Asie et les truffes d'Europe.** Comptes Rendus, vol. 113, Paris, Nov. 2, 1891, pp. 582–586. Discusses geographical distribution, climate, soil, host plants, time of maturity, depth in the soil, mode of gathering, culture, color, odor, taste, periderm, flesh or gelba, sporangia, spores, and chemical composition of truffles and terfazias. The latter are essentially African and Asiatic, fungi of hot climates, and are only represented in Southern Europe. Both prefer soils rich in lime and oxide of iron. Truffles grow at depths of 10–15 cm., but sometimes 40–50 cm. They rarely approach so near the surface as to lift the earth, but this is common in case of Terfazias, which are even found, growing partly out of the soil or under leaves. Truffles are generally parasitic on trees; Terfazias, on under shrubs, such as Cystineæ, or apparently even on annuals like Helianthus. Terfazias cover immense districts. They are gathered and dried by the Arab population, to whom they hold the same place as the potato to the Irish peasant. They contain less nitrogen and phosphorus than truffles, but are superior in this respect to potatoes. The yearly value of the Perigord truffle (*Tuber melanosporum*) exceeds 20,000,000 francs. (E. F. S.)

607. CHATIN, A. **Contribution à l'histoire botanique de la truffe (Kamés de Bagdad).** Rev. des Sci. Nat. et Appli., vol. 38, Paris, Nov. 20, 1891, pp. 582–584. Brief account of two truffles received in 1891 from M. Metaxas, of Bagdad, and referred to the genus *Terfezia*. One is described as *T. Hafizi*, n. sp., and the other is *T. Metaxasi*, n. sp. The author believes this genus will be found to be represented by as many species in the desert regions of Asia and Africa as is *Tuber* in the more temperate countries of Europe. (E. F. S.)

608. GAILLARD, A. **Observations d'un retour à l'état végétatif des Périthèces dans le genre Meliola.** Bull. Soc. Mycol. France, vol. 7, Paris, Sept. 30, 1891, pp. 151–152. Notes the fact that certain perithecia remain paler and smaller than others. These are sterile and their cells grow out into long mycelial filaments. (E. A. S.)

609. KNOWLES, H. G. **Truffles.** Repts. from consuls of U. S., No. 132, Sept., 1891, pp. 158–160. Considers truffles due to sting of insect. Notes method of hunting for them by pigs in France and describes training of dogs for the same purpose. Gives value of 452,361 pounds exported from France in 1889 at $476,147. Explains method of canning. (J. F. J.)

610. [? MASTERS, M. T.] **A Syrian Truffle.** Gard. Chron., 3d ser., vol. 10, London, Nov. 21, 1891, p. 617, ⅛ col. Notes that M. A. Chatin has described a peculiar truffle in Comptes Rendus. (See No. 604.) (M. B. W.)

(See also No. 445 and 637.)

III.—*Sphæriaceæ.*

611. ATKINSON, GEO. F. **On the structure and dimorphism of Hypocrea tuberiformis.** Bot. Gazette, vol. 16, Oct., 1891, pp. 281–284, pl. 1. Describes the ascigerous, sphacelial, and stromatous forms of the fungus, placing it in the genus *Hypocrella* of Saccardo. Considers the species distinct from *Dussiella* of Patouillard, and shows the near relation existing between the genera *Epichloe* and *Hypocrella*. Points to separation of the genera on ground of inclosure or non-inclosure of culm of host by the stroma of the fungus as a trifling one, and cites case of *Hypocrella*, which surrounds opening buds of *Andropogon Virginicus* as torn asunder by opening of the buds. Paper read before Bot. Club of Am. Asso. Adv. Sci., Aug., 1891. (D. G. F.) See notice in *Ibid.*, Sept. 1891, p. 256.

612. ATKINSON, GEO. F. **Sphærella gossypina, n. sp., the perfect stage of Cercospora gossypina, Cooke.** Bull. Torrey Bot. Club, vol. 18, Oct., 1891, pp. 300–301, pl. 1. Gives paper read before the Bot. Club of the Am. Asso. for Advancement of Science, Washington, Aug., 1891, describing *Sphærella gossypina*, n. sp., found very abundant upon leaves of *Gossypium herbaceum* attacked by *Cercospora gossypina*. Considers the *Sphærella* a perfect stage of the *Cercospora*. (D. G. F.) See title in Bot. Gaz., vol. 16, Sept. 15, 1891, p. 261.

613. COOKE, M. C. **Cordyceps Hawkesii, Gray.** Grevillea, vol. 19, London, Mar., 1891, pp. 76–78. Discusses the characters of the species as compared with other Australasian *Cordyceps*, and reprints the orignal description. (M. B. W.)

614. COOKE, M. C. **Memorabilia.** Grevillea, vol. 19, London, Mar., 1891, pp. 80–81. Notes that *Valsaria parmularia*, Berk., specimens so-called in Roumeguères's Fungi Gallici, No. 4338, is not that species, but probably *Valsaria rubricosa*, Fr.; *Epichloe hypoxylon*, Peck, is identical with *Hypocrella atramentosa*, B. & C.; *Agaricus* (*Galera*) *mucidolens*, Berk., belongs to *Hyporrhodii*. (M. B. W.)

615. COOKE, M. C. **New British fungi.** Grevillea, vol. 19, No. 91, London, Mar., 1891, p. 86. Describes *Hypocrea* (*Bromella*) *leptogicola*, Cke. & Mass., on *Leptogonium* growing upon *Robinia; Stuartella Carlylei* Cke. & Mass., *Mollisia dactylilyluma*, on *Dactylis glomerata*, and *Lachnella stigmella*. (M. B. W.)

616. DELACROIX, G. **Espèces nouvelles de champignons inférieurs.** Bull. Soc. Mycol. France, vol. 7, Paris, June 30, 1891, pp. 104–111, pl. 2. Describes *Plowrightia Karsteni, Herpotrichia ceralium, Ceratostoma truncatum, C. stromaticum, Nectriella maydis, Zignœlla culmicola*, Delacr. & Niel, *Chætomella longiseta, C. tortilis, Macrophoma carpincola, Coryneum faginum, Penicillium Duclauxi, Moronopsis* (nov. gen) *inquinans, Sterigmatocystis ochracea, Dictyosporium secalinum, Fusarium æruginosum, Fusicoccum populinum, F. complanatum*. (E. A. S.)

617. MACMILLAN, CONWAY. **Notes on fungi affecting leaves of Sarracenia purpurea in Minnesota.** Bull. Torrey Bot. Club, vol. 18, July, 1891, pp. 214–215. Gives notes on *Sphærella sarraceniæ* (Schw.) Sacc., *Leptosphæria scapophila* (Peck), Sacc., *Peziza abrata* and *Pestalozzia aquatica*, E. & E. Describes as new species *Helminthosporium sarraceniæ* and *Brachysporium sarraceniæ*. (D. G. F.)

618. PRILLIEUX ET DELACROIX. **Complément a l'étude de la maladie du cœur de la betterave.** Bull. Soc. Mycol., France, vol. 7, Paris, Mar. 21, 1891, pp. 23–25,

fig. 9. *Sphærella tabifica*, a new species found in connection with *Phyllosticta tabifica* is considered as the ascomycetous form of the latter. Describes this together with the following new species found in connection with the *Phyllosticta: Ascochyta betæ, A. beticola, Diplodia beticola.* (E. A. S.)

619. Westwood, I. O. **Parasites on Plants and Animals.** Gard. Chron., 3d ser., vol. 9, London, May, 1891, p. 553, 2 cols., fig. 4. Popular description of the external appearance of *Cordyceps* on larvæ. (M. B. W.)

(See also Nos. 392, 445, and 621.

IV.—*Discomycetes.*

620. Boyer. **Note sur la Reproduction des Morilles.** Bull. Soc. Mycol., France, vol. 7, No. 3, Paris, Sept. 30, 1891, p. 150. Gives details of a successful experiment in reproducing the Morel on a substratum apparently free from infection before sowing on it the débris of some partially liquefied specimens. (E. A. S.)

621. Cooke, M. C. **Omitted Diagnoses.** Grevillea, vol. 19, London, March, 1891, pp. 71–75. Contains descriptions of 23 species of fungi which are not found in Saccardo's Sylloge, in the genera *Peziza, Sphæria, Helotium, Phialia, Lachnella, Bulgaria, Ombrophila, Ryparobius, Patellaris, Phacidium,* and *Phoma*- (M. B. W.)

622. Phillips, W. **Omitted Discomycetes.** Grevillea, vol. 19, No. 92, London, June, 1891, pp. 106–107. Contains descriptions of the following species not in Saccardo's Sylloge. *Aumaria stomella* Cke. and Phil., n. sp., *Hymenoscypha Carmichælii,* Berk., Phil., *H. flexipes,* Cke. and Phil., *Helotium aurantiacum,* Cke., *Mollisia chlorosticta,* E. P. Fries, *Lachnella luzulina,* Phil. = *Dasyscypha hyalina* (Phill.) Sacc., *L. albopileata,* Cke. var. *subaurata,* Ellis; *L. conformis,* Cke., *Encælia hypochlora* Berk. and Curt. (M. B. W.)

(See also Nos. 445, 452, 615, and 644.)

I.—IMPERFECT AND UNCLASSIFIED FORMS.

I.—*Hyphomycetes and Stilbeæ.*

623. Boudier, Em. **Quelques nouvelles espèces de Champignons inférieurs.** Bull. Soc. Mycol., France, vol. 7, No. 7, Paris, June 30, 1891, pp. 81–83, pl. 1. Describes the following new species: *Botrytis albido-cæsia, Mycogone ochracea, Volutella albopila, Hymenula citrina.* (E. A. S.)

624. Dufour, Jean. **Le Champignon parasite des vers blancs.** Chron. Agric. Vit. et Fores. du Vaud, vol. 4, Lausanne, Nov. 10, 1891, pp. 376–384. Gives some general notes on the presence of entomogenous fungi. Describes the ravages of *Botrytis tenella* on the white worm, and mentions the consequent attempts to propagate the fungus by infecting worms with spores produced in artificial cultures. In order to test this, several experiments were tried. Healthy worms were infected, both confined in pots and in the open ground. The worms seemed to resist the parasite even in the closed pots, and more strongly in the open ground. The conditions favoring a rapid infection are not yet known. (E. A. S.)

625. Giard, Alfred. **Nouvelle recherches sur le Champignon parasite du hanneton vulgaire (Isaria densa, Link).** Comptes Rend., Soc. Biol., new ser., vol. 3, Paris, July 23, 1891, pp. 575–579. Shows that the fungus of the white worm was common in Lower Seine in 1866. Since then the equilibrium between the insect and its parasite has been preserved. The balance could, however, be turned in favor of the latter by spreading liquid cultures of the spores over the infested territory. The article contains the same notes on synonomy as No. 624. (E. A. S.)

626. Girard, Alfred. **Sur la transmission de l'Isaria du ver blanc an ver à Soie (Isaria densa, Link).** Comptes Rend., Soc. Biol., new ser., vol. 3, Paris, July 2, 1891, pp. 507–508. Shows that it is possible to infect the silk worm with the *Isaria* of the white worm. Hopes in this way to discover whether the *Isaria* is modified by its change of hosts and whether it approaches *Botrytis Bassiana*. Suggests that care should be used in spreading the *Isaria* over regions where the silk worm is raised. (E. A. S.)

627 Mayo, N. S. **Enzootic cerebritis, or "staggers" of horses.** Bull. Kansas State Agric. Ex. Sta., Vet. Dept., No. 24, Manhattan, Sept., 1891, pp. 107–116, pl. 1. Reports results of experiments with moldy corn as the supposed cause of the "blind" or "mad staggers." Thinks the spores of *Aspergillus glaucus* are capable, when introduced into the circulation of the animal, of producing the disease. The presence of the growing mycelia thought to be ascertained in the liver of guinea pig inoculated with water containing spores of the fungus. Gives result of experiment with colt fed upon corn covered with *Aspergillus glaucus*, attributing final death of the animal to presence of the spores of the fungus in its system. (See also Rept. Kansas State Board Agric., Topeka, Sept., 1891, pp. 42–50; noticed in Exper. Sta. Rec., vol. 3, January, 1892, pp. 388–389.) (D. G. F.)

628. Prillieux et Delacroix. **Endoconidium temulentum, nov. gen. nov. sp., Prill. et Dela., Champignon donnant au seigle des propriétés vénéneuses.** Bull. Soc. Mycol., France, vol. 7, No. 2 June 30, 1891, pp. 116–117, fig. 2. Describes the new genus, *Endoconidium*, having the spores formed within a tube. Species *E. temulentum*, found on rye in 1890, in the department of Dordogne, and giving it a poisonous quality. On a few of the same grains was found another new species, *Fusarium miniatum*, related to *F. ruberrimi*, Dela. (E. A. S.)

629. Skuse, F. A. A. **The New Zealand vegetable caterpillar.** Victorian Naturalist, vol. 8, Melbourne, June–July, 1891, pp. 47–48. Refers to paper by Thos. Steel, and states that the larva attacked by the fungus *Isaria Robertsii* is not that of *Hapialus virescens*. Quotes from other authorities in reference to this point, and it therefore remains a question as to the species attacked by the fungus. (J. F. J.)

630 Thaxter, Roland. **On certain New or Peculiar North American Hyphomycetes, II.** Bot. Gazette, vol. 16, July, 1891, pp. 201–205, pl. 2. Describes *Helicocephalum sarcophilum*, nov. gen. et nov. sp., on carrion from Conn., found in laboratory cultures; *Gonatorrhodiella parasitica*, nov. gen. et nov. sp., on *Hypocrea* and *Hypomyces; Desmidiospora myrmecophila*, nov. gen. et nov. sp., on the body of a large ant, Conn. Remarks this latter species may possibly be an imperfect form of *Cordyceps unilateralis*, Tul., and suggests possibility of its being parasitic on young *Isaria* or *Cordyceps* previously developed on the insect. Describes also *Everhartia lignatilis*, nov. sp., on wet logs from Conn., figuring *E. hymenuloides* Sacc. and Ellis for comparison. (D. G. F.)

631. Trabut, L. **Les Champignons parasites du Criquet Pelerin.** Rev. Gen. Bot., vol. 3, No. 34, Paris, Oct. 15, 1891, pp. 401–405, pl. 1. Notes a fungous disease on the migratory locust (*Acridium peregrinum*) in Algeria, found especially on females after laying the eggs. The fungus was named *Botrytis acridiorum* by the author, and *Lachnidium acridiorum* by Giard, the latter name being adopted in the article. MM. Knuckel and Langlois have referred it to *Polyrhigium leptophyci*, Giard. The fungus develops on all the membranes covering the joints, but more especially between the abdominal rings. It is entirely superficial never penetrating the body cavities. Two kinds of spores have been found—one round and unicellular, the other elongated and septate. The article also describes *Cladosporium herbarum*, var. and *Saccharomyces? parasitaris* as parasitic on the bodies, and *Oospora ovorum*, n. sp. on the eggs of the insects. (E. A. S.)

(See also Nos. 445, 541, 612, 616, and 617.)

II.—*Sphæropsideæ and Melanconeæ.*

632 PAMMEL, L. H. **Spot Disease of Cherry** (**Cylindrosporium padi.**) Bull. Iowa Agric. Ex. Sta. [Ames], No. 13, Des Moines, May, 1891, pp. 55–66, pl. 2, fig. 3. Discusses synonomy of the species and describes the microscopic characters of the fungus with list of plants affected by it. (D. G. F.)

633. PAMMEL, L. H. **Spot Disease of Currants and Gooseberries.** Bull. Iowa Agric. Ex. Sta. [Ames], No. 13, Des Moines, May, 1891, pp. 67–71, figs. 3. Discusses the literature and geographical distribution of *Septoria ribis*, Desm., *Cercospora angulata*, Wint. and *Glœosporium ribis*, Peck. Expresses the opinion that the *Cercospora* is the fungus which causes in part the defoliation of white and red currants. Thinks *Sphærella grossulariæ*, Fr. is genetically connected with *Cercospora angulata*, Wint., and also with *Septoria ribis*, Desm. (D. G. F.)

634. PRILLIEUX ET DELACROIX. **Hendersonia cerasella, nov. sp.** Bull. Soc. Mycol., France, vol. 7, No. 1, Paris, Mar. 31, 1891, pp. 21–22, figs. 2. Describes *Hendersonia cerasella*, a new species found on the sterile spots of *Coryneum Beijerinckii* on cherry leaves. (E. A. S.)

(See also Nos. 383, 391, 445, 616, 617, 618, and 621.)

III.—*Miscellaneous.*

635. COMSTOCK, J. H., and SLINGERLAND, M. V. **Wireworms.** Bull. Cornell Univ. Agric. Ex. Sta., entomological division, No. 33, Ithaca, Nov., 1891, p. 211. Notes *Metarrhizium anisopliæ*, as determined by Thaxter, attacking and killing the larvæ of wireworms under experiment. (D. G. F.)

636. MASSEE, GEO. **Sarcomyces, new genus.** Grevillea, vol. 20, London, 1891, pp. 13–14. Describes *Sarcomyces vinosa* nov. gen. and nov. sp., on wood from Venezuela and South Carolina. (D. G. F.)

637. SOUTHWORTH, EFFIE A. **Notes on some curious fungi.** Bull. Torrey Bot. Club, vol. 18, Oct., 1891, pp. 303–304. Describes briefly peculiar fungus, possibly *Polyporus officinalis* from California, and *Erysiphe* like form on *Muhlenbergia;* also a superficial fungus on bark of orange likely to prove a species of *Phymatomosphaeria.* (D. G. F.)

(See also Nos. 437, 445, and 631.)

G.—MORPHOLOGY AND CLASSIFICATION OF BACTERIA.

638. BLANCHARD, Dr. R. **Sur un Spirille géant développé dans les cultures de sédiments d'eau douce d'Aden.** Rev. gén. sci., pure et appliq., 2 ann. Paris, Jan. 15, 1891, pp. 21–22, figs 8. Review of a paper by A. Certes in Bull. de la Soc. Zool. de France, t. 14, p. 322. (E. F. S.)

639. HENNEGUY, F. **Contribution à l'étude de la morphologie et du développement des Bactériacéaes.** Rev. gén. sci., pure et appliq., 2 ann. Paris, Jan. 15, 1891, p. 21. Review of a paper by A. Billet in Bull. Scientifique du Nord de la France et de la Belgique, t. 21, 1890. (E. F. S.)

611. MANGIN, L. **Die Pflanzen und Thiere in den dunklen Raumen der Rotterdamer Wasserleitung.** Rev. gén. sci. pure et appliq., 2 ann., Paris, Mar. 30, 1891, p. 193–194. Review (in French) of a paper by Hugo de Vries on the presence of *Crenothrix Kuhniana* in the water supply of Rotterdam. (E. F. S.)

642. METCHNIKOFF, E. **Les idées nouvelles sur la structure, le développement et la reproduction des bactéries.** Rev. gén. sci. pure et appliq., 2 ann., Paris, April 15, 1891, pp. 211–216, figs. 14. The author considers bacteria most nearly related to the lower algæ. The possession of a true nucleus, which often fills nearly the entire cell; the occurrence of pleomorphism, now proved for pathogenic

as well as saprophytic forms; the existence of gelatinous zoögloea; the existence of cilia, even in Coccus forms, and the multiplication by fission are all bonds of kinship with Cyanophyceæ. One objection to this view is the total absence of endospores in algæ. The formation of endospores connects the bacteria with the flagellate infusoria, while in their branching they recall fungi. Botanists have laid great stress on the fact that the spores of some bacteria germinate at the poles and others at the equator. The fact is, both methods occur in the same species. (E. F. S.)

(See also Nos. 527, 543, and 588.)

H.—MORPHOLOGY AND CLASSIFICATION OF MYXOMYCETES.

643. Balliet, Letson. **Slime molds.** The Ornithologist and Botanist, vol. I, Binghamton, N. Y., Nov., 1891, p. 85, 1 col. Under this heading, describes popularly *Protococcus* on flowerpots. (D. G. F.)

644. Bucknall, Cedric. **The fungi of the Bristol district.** Part XIII, Proc. Bristol Nat. Soc., new ser., vol. 6, Bristol, 1891, pp. 274–277. A list of thirty fungi of various orders added to the flora of Bristol, with descriptions of some of the species. The following are described as new: *Oligonema furcatum, Perichæna confusa,* Masse in litt., *Lachnella fragariastri,* Phil. in litt. (M. B. W.)

645. Lister, Arthur. **Notes on Mycetozoa.** Jour. of Bot., vol. 29, London, Sept., 1891, pp. 257–268, pl. 5. Contains descriptions of fourteen species not included in Cooke's Myxomycetes of Great Britain, with five plates. The following new species are described: *Physarum calidris, Cornuria depressa, Hemiarcyria intorta.* (M. B. W.)

646. Niel, M. **Remarques à propos des Tubulina fragiformis, Pers., et cylindrica, Bull.** Bull. Soc. Mycol. France, vol. 7, No. 2, Paris, June 30, 1891, p. 98. Points out the differences between the two species as mentioned in previous descriptions. Does not see Saccardo's reasons for combining them. (E. A. S.)

647. Rex, Geo. A. **Hemiarcyria clavata, Pers.** Proc. Acad. Nat. Sci. Phila., Part II. Phila., 1891, pp. 407–408. Records discovery of spinose processes on the spiral thickenings of the threads of capillitium of this species by use of oil immersion lens. (D. G. F.)

648. Rex, Geo. A. **New American Myxomycetes.** Proc. Acad. Nat. Sci. Phila., Part II. Phila., 1891, pp 389–398. Describes the following species as new: *Physarum nucleatum, Physarum penetrale, Chondrioderma aculeatum, Stemonitis Webberi, Stemonitis Virginiensis, Stemonitis nigrescens, Comatricha irregularis, Cribraria violacea, Cribraria languescens, Trichia Andersoni, Hemiarcyria longifila, Hemiarcyria Varneyi, H. obscura, Dianema,* nov. gen., *D. Harveyi.* (D. G. F.)

649. Rex, Geo. A. **Trichia proximella, Karst.** Proc. Acad. Nat. Sci. Phila., Part III, Dec. 16, 1890, pp. 436–438. Gives comparison of *Trichia proximella* Karst, and *T. Jackii* Karst, and a series published in Journal of Mycology, Aug., 1886, as possessing diagnostic characters of *T. affusis,* DBy. and *T. Jackii,* Rostf. Decides all three as forms differing only in development. (D. G. F.)

650. Wingate, Harold. **Note on Stemonitis maxima, Sz.** Proc. Acad. Nat. Sci. Phila., Part II. Phila., 1891, p. 438. Gives result of examination of type specimens of *Stemonitis maxima,* Sz., found in Schweinitz herbarium which he decides is identical with a form found commonly in vicinity, to be issued shortly in N. Am. Fungi. (D. G. F.)

(See also No. 652.)

J.—TECHNIQUE.

652. Cook, O. F. **Methods of collecting and preserving Myxomycetes.** Bot. Gazette, vol. 16, Sept. 15, 1891, p. 263. Notice of remarks made before the Bot. Club of A. A. A. S., Aug., 1891, describing method of preservation of specimens of *Myxomycetes* by use of two stiff pieces of cardboard, separated by strips of cork glued to each end, between which the specimens are glued. The two pieces of cardboard are then inclosed in an ordinary herbarium pocket. (D. G. F.)

653. Graziani, A. **Les réactifs utilisés pour l'etude microscopique des champignons.** Bull. Soc. Mycol. France, vol. 7, Paris, Sept. 30, 1891, pp. 189–192. A list of reagents used in studying fungi, together with formulæ for those that are not simple liquids or solutions. (E. A. S.)

(See also Nos. 545, and 647.)